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Canadian Pacific



CANADIAN GEOGRAPHICAL JOURNAL

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CONTENTS

NOVEMBER, 1945 + VOLUME XXXI + NUMBER 5

COVER SUBJECT:—Homecoming—sailor's
family welcomes Dad at Halifax.

	Page
THE SAGA OF THE ROYAL CANADIAN NAVY Grand Assessment.....	203
by COMMANDER (S.B.) WILLIAM STRANGE, R.C.N.V.R.	
WATER TRANSPORTATION IN THE CANADIAN NORTHWEST.....	236
by J. L. ROBINSON	
THE CRAFT OF THE GEOGRAPHER.....	257
by GEORGE H. T. KIMBLE	
EDITOR'S NOTE-BOOK.....	VIII
AMONGST THE NEW BOOKS.....	IX

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Official Photograph of
Burial at Sea, with full Naval
honours, for 18 year old
Ordinary Seaman, on board
H.M.C.S. Anishnabe killed
by fire from a U Boat.

We Will Remember

*They went with songs to the battle, they were young,
Straight of limb, steady and aglow,
They were staunch to the end against odds uncounted,
They fell with their faces to the foe.*

*They shall grow not old, as we who are left grow old,
Age shall not weary them, nor the years condemn.
At the going down of the sun in the morning
We will remember them.*

—LAWRENCE BINYON

How better can we remember those who died, and in some small measure repay our deep obligations for their sacrifice, than by buying Victory Bonds? Buy — in tribute to their memory. Buy — that those who came back may be restored to health and the fullness of living. Buy — in deep thankfulness for the freedom which they fought to preserve. And, with only one Victory Loan in twelve months, buy more Victory Bonds than ever before.

SIGN YOUR NAME FOR VICTORY



NATIONAL WAR FINANCE COMMITTEE



The Saga of the Royal Canadian Navy

Grand Assessment*

by COMMANDER (S.B.) WILLIAM STRANGE, R.C.N.V.R.

THESE ARE DAYS WHEN, with the nightmare of World War II passing somewhat rapidly from the public mind, and with popular interest focused, very naturally, on the problems—and the pleasures, too—of peace, we can easily enough forget the lessons taught us by the fearful days of conflict through which the world has passed.

The early terrors of the German blitzkrieg, the swift unprecedented advances across Europe, the great air-battles over Britain, the dark days of the night-bombing

when London learned to “take it”, the battle for the sea-lines, the treacherous blow at Pearl Harbour, and the dismaying track of Japanese conquest moving with seeming inexorability to the gates of Australia—these and a dozen other body-blows sustained by the Democracies can far too easily be forgotten in the current rejoicings over a victory achieved, eventually, somewhat sooner than we had all expected.

It is easy to forget the darker days. it is hard to remember the lessons. Yet, if we are

*Illustrated with official Naval photographs.

Top:—Canadian Wrens greet homeland from the Ile de France.





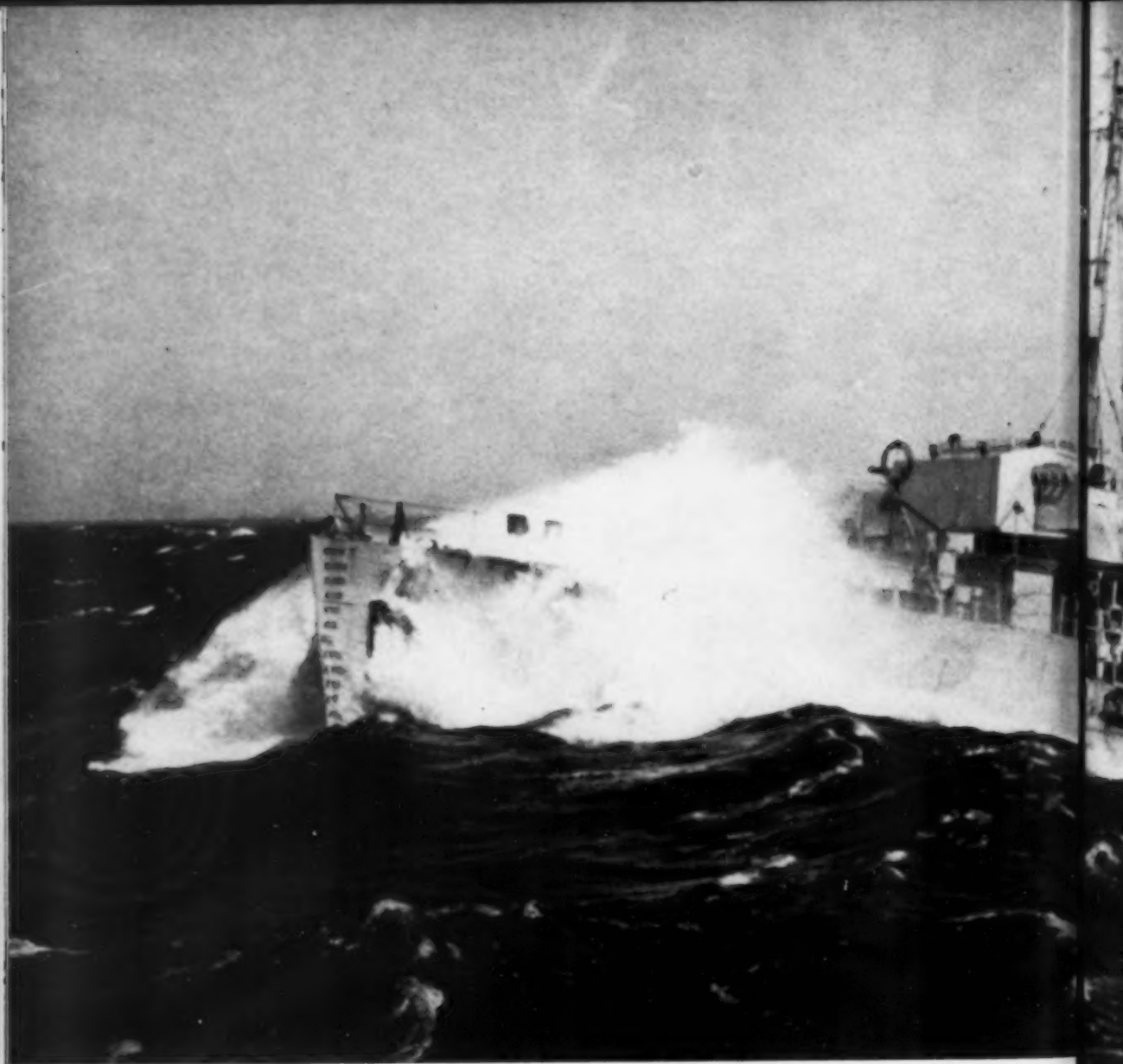
The bows of the frigate, H.M.C.S. Penetang, are lifted high by a heavy Atlantic swell.

to pass on the heritage of freedom now defended with success, though at great cost, we shall be wise indeed to remember the difficult times, and wiser still to hold the memory of the lessons taught with all the tenacity of which our minds may be capable.

Perhaps the most important lesson of all is the value of sea-power. The possession of sea-power by the British in the sombre days following the collapse of France made the hazards of invasion too great for Hitler's (then) daring spirit. Sea-power made possible the landings in Africa, the supply of Britain, the invasion of Europe, the great land victories, and final subduing of the German forces. It also made possible the

Japanese advances in the Pacific, and—upon the turn of the tide—the American and Allied reply.

When the first call to arms was sounded and the half-dozen destroyers of the Royal Canadian Navy obeyed their first operational orders of the war, no man or woman in Canada had the faintest conception of the magnitude of the task the R.C.N. would eventually be called upon to perform. To have suggested, in those stirring and uncertain days, that Canada's 'tin-pot' Navy was embarking on a course which would ultimately have real influence on the balance of sea-power in the Western Hemisphere would have been to invite loud mirth. Nevertheless, that is precisely what was



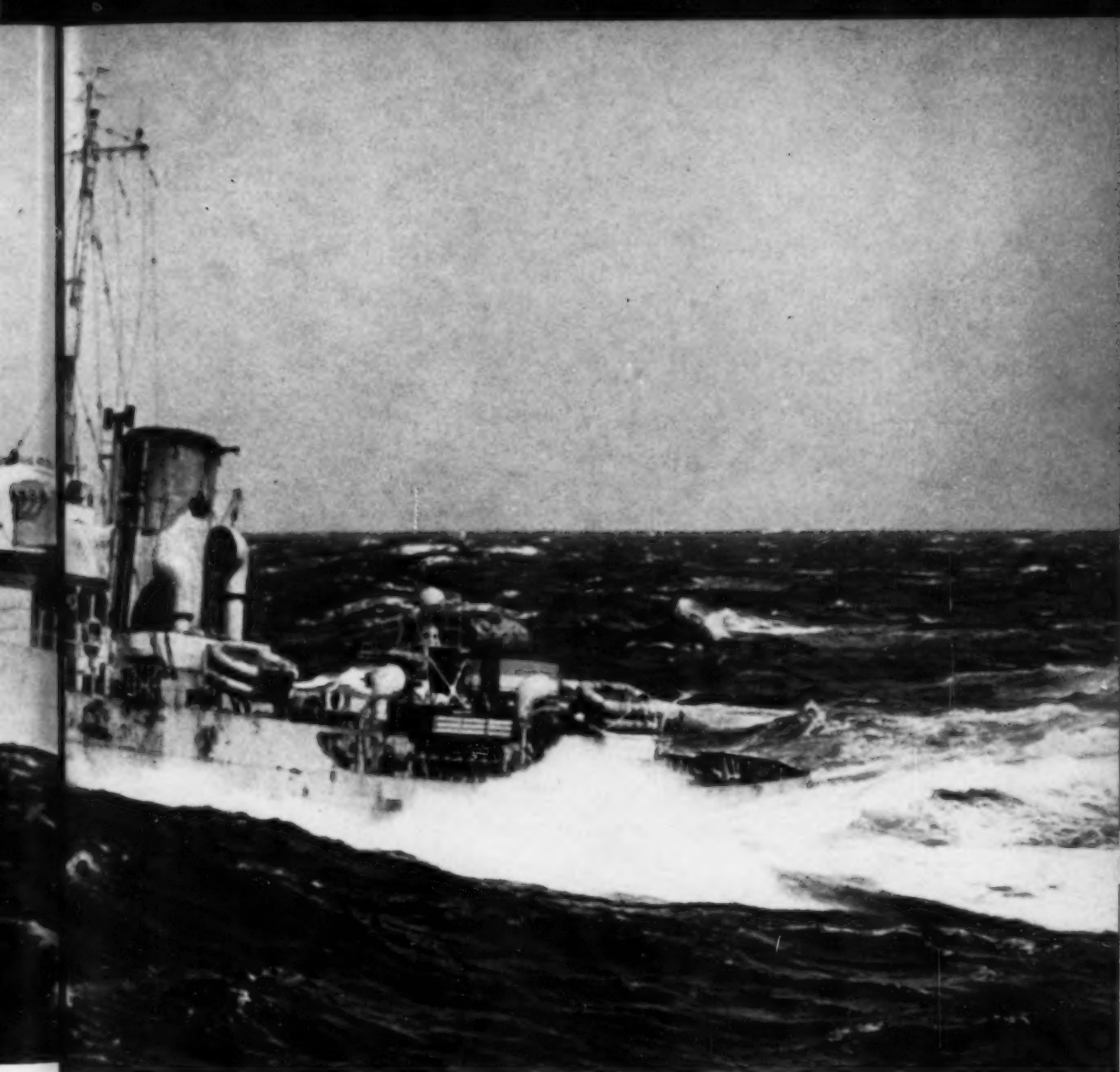
The top deck of a corvette was an uncomfortable place to be in a gale. The general feeling could be found below decks, where the general feeling was one of discomfort.

happening. It led to quietly spectacular achievement, and a firm part in the control of the vital Atlantic life-line which unquestionably influenced the course of the war. The six destroyers expanded, eventually, into an escort fleet of 378 fighting ships whose total achievement *in the North Atlantic alone* amounted to the successful convoy of 25,343 merchant ships carrying 181,643,180 tons of cargo from North America to United Kingdom ports.

Unfortunately, this is one of those figures

whose magnitude is so difficult to grasp that it does not easily "register". Perhaps a break-down of a single convoy may help.

On July 17th, 1944, a convoy known in the Navy as HXS300 left the port of New York 109 ships strong. It was enlarged in the first days of its passage by additional sections of ships from Halifax (31), Sydney, Nova Scotia (24), and St. John's, Newfoundland (3). Eventually this mercantile armada numbered 167 ships. Under all-Canadian escort—except for four carriers



*...e place
...neral fe* gales swept the North Atlantic. Not much more comfort
...ne of being rolled about inside some gigantic churn.

in the convoy—it arrived on schedule and intact after an uneventful passage.

Here is what it carried:—

Grain.....	84,561 tons
Sugar.....	84,948 tons
Other foods	47,167 tons
Lumber	35,588 tons
Oil.....	307,874 tons
Molasses	37,500 tons
Iron & steel	36,705 tons
Other general cargo.....	80,699 tons
Vehicles & tanks	55,490 tons
Other military equipment ..	251,597 tons

It may seem curious that, in an article dealing with the Canadian Navy's part in holding the sea-power that won the war, much stress should be laid upon tonnages of molasses and lumber, of steel and sugar, and of grain. Yet, it has to be remembered that World War II was, to a transcendent extent, a war of supply; for the Allies, a war of supply *by sea*. Supply, indeed, became, in time, the key to success. This hard, inexorable fact was actually—as every school-child knows—the genesis of the

great five-and-a-half-year U-Boat campaign.

In that five-and-a-half years (five years and eight months to be exact) the Royal Canadian Navy expanded in effective fighting ships from six to 378: in personnel, from 3,604 to 95,705—including reserves. It sank seventeen U-Boats, joined with other Allied ships in sinking another ten, and got credit for probably sinking or damaging several more. (This figure does not include U-Boats surrendered after Germany's capitulation). It sank, destroyed, captured or damaged at least thirty-one enemy surface craft: it joined with British or other allied ships in sinking, destroying, damaging or capturing another eighty. Its ships ranged not only the Atlantic, but also the Caribbean Sea, the Mediterranean, the route to Murmansk, the English Channel, the North and Irish Seas, and the Pacific. It built for itself, at Deep Brook in Nova Scotia, the largest naval training establishment of its kind in the British Empire.

It manned its ships as they came, a steady tide, from the shipyards of Canada. It trained its seamen, its specialists, its officers and captains. It put a moving steel wall, of steadily increasing defensive strength, around the convoys. It lost twenty-three ships, and 1,669 men.* Four hundred and thirty-six Canadian naval men were wounded*, and 1,469† were awarded decorations and Mentions in Despatches for every form of heroism, and for the innumerable forms of devotion to the job "beyond the call of duty" which win battles and skirmishes, or merely help to get the convoys through.

It is a not unimpressive achievement. To it must be added the fact that the Navy, as the final curtain fell upon the war in Asia, was far advanced in the matter of making ready a fleet of cruisers, aircraft-carriers, up-to-date destroyers and frigates which would undoubtedly have given an excellent account of itself had it but had the chance!

How easy it is to set down facts and figures on paper: how infinitely difficult to bring these cold statistics into their true

perspective, and to lively meaning for the reader!

There is a great saga of co-ordinated effort behind the facts. It began, actually at Naval Service Headquarters well before the outbreak of the war when plans were laid to set up a system of control of merchant shipping, for the routing of ships, the assembly and sailing of convoys. It was, indeed, a part of a much larger, world-wide plan based largely on experience gained in the last war. It made it possible, immediately on the opening of hostilities, for the entire control of merchant shipping under allied protection to pass into the hands of the Navy.

Actually, this took place even a few days before the war, for it was on August 26th, 1939, that the British Admiralty signalled to all its Intelligence Centres (of which Ottawa was one) that all British merchant ships had passed from the control of their owners to that of the Admiralty. This date, then, was the real beginning of the war at sea.

Of this aspect of our naval activity, Canadians know very little. It has never been particularly spectacular, but the truth is that, without the Naval Trade Division at Ottawa, and the Naval Control Service directed by its head, there could have been no North Atlantic convoy system at all.

The job was done by a handful of men working at a furious pace, grabbing a sandwich for lunch, sleeping when they could, improvising as they must, sharing totally inadequate offices. . . . It is a story not peculiar to the R.C.N., for in those early days the few experts carried the entire burden in many comparable situations throughout the limited professional fighting services of the British Commonwealth. But, if all the fighting services were limited, it can probably be said that, due to the non-maritime thinking of the vast majority of Canadians and our mistaken reliance upon the British and United States Navies for naval defence, the Royal Canadian Navy was a

*To August 15th, 1945

†To August 21st, 1945

Right:—The long and bitter Battle of the Atlantic has ended, and a 'Castle' class corvette, one of the latest types to guard the Atlantic sea-lanes, steams outward through the towering rocky portals of the harbour at St. John's, Newfoundland, on her way to a Canadian port.



"hot" candidate for being rated the most limited of all.

The six destroyers—*Skeena*, *Saguenay*, *St. Laurent*, *Fraser*, *Ottawa* and *Restigouche*—went gaily and grimly into the battle. They were all we had to send. They were well commanded, and manned with crews whose efficiency was no whit below any in the world. The fact remains—and, let us hope, the lesson, too—that they were fantastically inadequate for the task that loomed ahead, for the U-Boat was in mass-production in a greatly improved form. The U-Boat, a serious menace in World War I had, late in that war, eventually been overcome, largely by the belated introduction of the convoy system. It was far too often discounted as a potential menace in World War II in the early days.

The truth, however, was that it had been so developed in range, speed and general

effectiveness that it was an infinitely more serious menace than in World War I. On top of this, new tactics—notably the attack by 'wolf-packs'—had been evolved. The danger was enormously enhanced by the collapse of France, which not only removed an ally, but gave the Germans immensely valuable bases on the French Coast. It is to be remembered, too, that the southern Irish bases, available to the Royal Navy in World War I, were now in neutral hands. One further serious factor was the heavy loss in destroyers suffered by the Royal Navy during the initial phases of intensive fighting and following the evacuation at Dunkirk.

The fact is that it was an almost completely disastrous situation. We were in the gravest danger of losing command of the sea in the most vital area of all—the North Atlantic.



Bottom left:—Hon. Angus L. Macdonald, former Navy Minister (centre), and Vice-Admiral G. C. Jones, C.B., (extreme right), meet ocean escort captains.

Right:—Hon. Douglas C. Abbott, P.C., K.C., B.C.L., who became Minister of National Defence for Naval Services in April, 1945.

Below:—Hon. Douglas C. Abbott attends his first meeting of the Naval Board.





Shown here are the members of the Naval Staff in session. Left to right:—Captain D. W. Farmer, R.C.N., Hydrographer; Commander J. H. Arbick, R.C.N.V.R., Director of Naval Air Division; Commander H. C. Little, R.C.N.V.R., Director of Naval Intelligence; Captain D. L. Raymond, R.C.N., Director of Warfare and Training; Captain H. S. Rayner, Director of Plans; Commodore H. G. DeWolf, R.C.N., Assistant Chief of Naval Staff; Vice-Admiral G. C. Jones, R.C.N., Chief of Naval Staff; Lieutenant (S) A. N. How, R.C.N.V.R., Deputy Secretary Staff; Commander (S) K. C. Cooper, R.C.N.V.R., Secretary Staff; Captain E. S. Brand, R.C.N., Director of Trade Division; Professor J. H. Johnstone, Director of Operational Research; Captain D. K. Laidlaw, R.C.N., Director of Operations Division; R. O. L. King, Director of Scientific Research and Development; Captain J. M. de Marbois, R.C.N., Director of Operational Intelligence Centre; Captain G. A. Worth, R.C.N., Director of Signals Division; Commander A. C. Bethune, R.C.N.V.R., Supply Liaison Officer.

It was this situation that brought the corvette into existence as the earliest weapon the R.C.N. could bring to bear. A great deal has been written about the corvette—much of it arrant nonsense. It had certain immediate advantages, however. It could be built in small shipyards unsuitable for the construction of destroyers and other warships of more complicated construction. It was remarkably sea-worthy. It could carry depth-charges and other devices such as asdic and radar, and it was amongst the most manoeuvrable ships afloat. It had one

most serious disadvantage on which (not unnaturally) no stress was laid in published matter during the war: it lacked speed. U-Boats could run from it on the surface. The speed of the corvette was thus a somewhat closely guarded secret!

Probably one of the most courageous decisions of the war was that taken by the Canadian Government involving the high-speed construction of corvettes in Canadian shipyards, and their manning by crews who were—with a comparative handful of exceptions—totally inexperienced. It at once

involved the R.C.N. in training and manning problems of some magnitude. At no time, however, was there a recruiting problem.

The recruiting and initial training was conducted through the Divisional Centres of the Royal Canadian Naval Volunteer Reserve, facilities for more advanced training being set up at the two coasts (principally at Halifax), and ultimately being centralized at the large and up-to-date establishment at Deep Brook, Nova Scotia, and known as H.M.C.S. *Cornwallis*. The training programme became, with the passage of time, very considerable. In the meantime, however, it was necessary to get on with the war with such material as was already at hand. There was not very much, but, to quote a hoary English music-hall song, "What there was, was good".

The early corvettes, hopeful but experimental in many ways, were nearly all commanded by officers of the R.C.N.R.—peace-time merchant-marine officers with varying amounts of naval training or last-war service. The remaining officers had, in many cases, yachting experience, but enthusiasm and willingness to learn was their main stock-in-trade. Here and there on the lower-deck would be found men with varying degrees of nautical knowledge or experience. Apart from this, the ships were manned by landsmen—who suffered alarmingly from sea-sickness. A corvette is particularly well calculated to produce sea-sickness.

One of the many problems consequent upon the establishment of a regular trans-atlantic convoy-plus-escort system was that of refuelling the escort vessels. It was not until later in the war that the practice of refuelling at sea was adopted as standard. Failing such facilities, it was vitally necessary to arrange refuelling bases in the Atlantic. Escort vessels, especially when engaged actively against submarines, frequently have to steam at high speeds, sometimes for long periods. This involves heavy fuel consumption, and often caused great anxiety to commanding officers of the ships concerned.

For a considerable period following the fall of France the port of Reykjavik, in Iceland, was used as a base. It had, however, many disadvantages, being far to the North, limited in facilities, and its weather very bad. Eventually it was but little used, whilst St. John's, Newfoundland, was developed somewhat extensively as a main base for the ocean-escort groups.

St. John's, originally developed by the Royal Navy, was later taken over by the R.C.N., developed considerably further, and was the Headquarters of the Flag Officer, Newfoundland Force.

Far from slowly, and with persistence and courage, the Canadian Navy was taking its place—no longer as a small auxiliary force, but as a definite escort fleet—in the great struggle for sea-power in the Atlantic.

The job had, by now, become both complicated and extensive. The U-Boats, steadily increasing their range, were operating not only in mid-ocean, but (following the entry of the United States into the war) were now ranging the North American coastal areas, and even attacking—with marked success—down in the Caribbean.

In these circumstances, it became necessary for the R.C.N. to provide escorts not only for the ocean-crossing, but for convoys between Halifax and Boston or New York, Halifax still being the main assembly port for the ocean-trade convoys.

These were days as hectic as ever experienced by fighting men at sea. The convoy lanes were strewn with wreckage, and the overworked corvettes, manned by sleepless men learning the trade as they fought, spent many a disheartening night dropping depth-charges without visible result, and many a sad and strenuous hour wrestling dark oily waters for the lives of men.

The threatened area was great: the threat was very real. The Navy, long before the average Canadian had more than an inkling of the truth, was thinly-spread from Belle Isle Strait to Trinidad. And out in the wind-swept chill Atlantic wastes, the little ships steamed on . . .



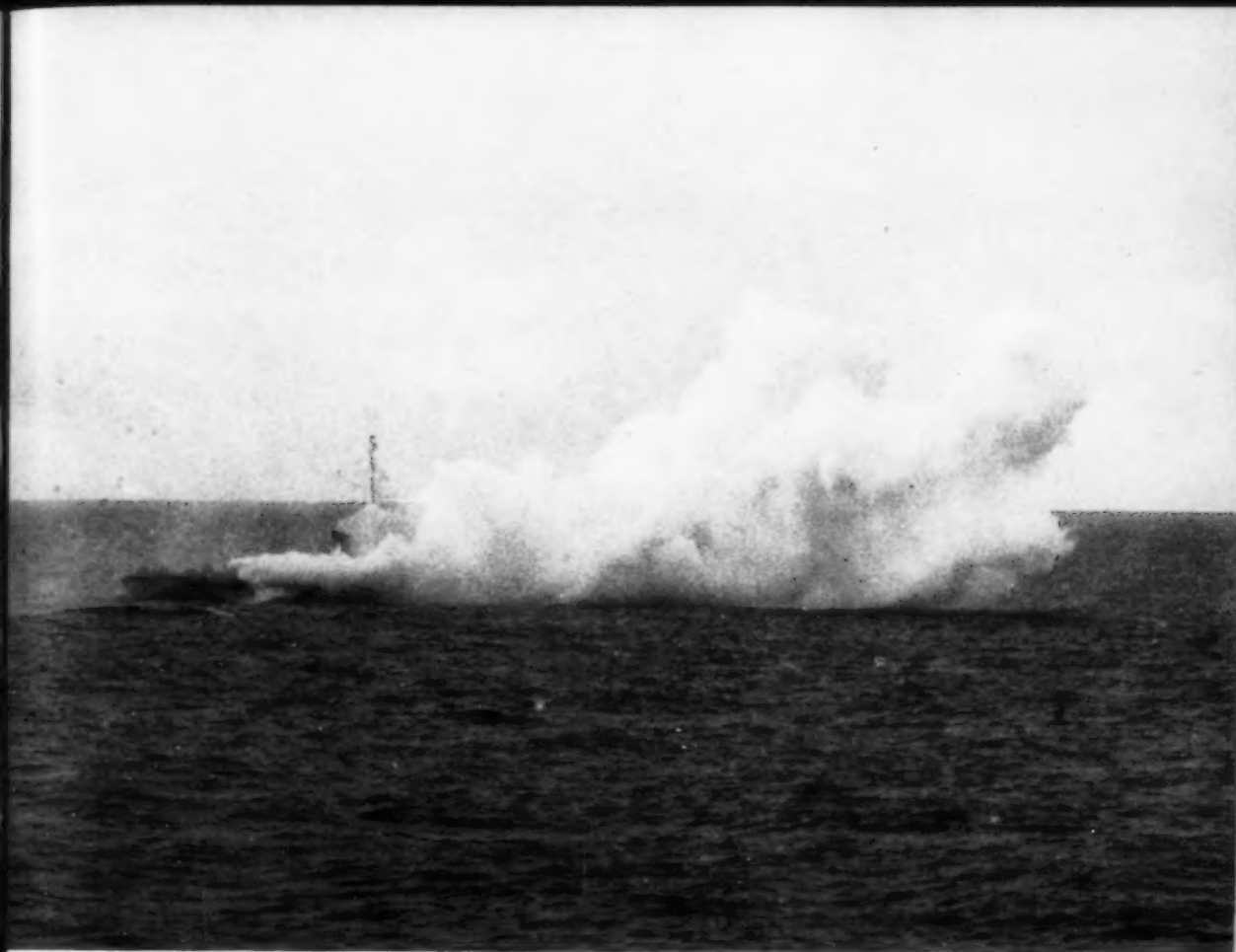
Above:—A vast armada of merchant ships rests in the quiet waters of Bedford Basin at Halifax before the start of the perilous journey in convoy to the United Kingdom.





Above and at left are shown floats and networks of steel cable that guarded Canadian harbours against attack from U-Boats and their deadly torpedoes.





Above:—A torpedo intended for Nabob hits the British frigate, H.M.S. Bickerton.

Top left:—Down by the stern after a torpedo had found its mark, Nabob, Canadian-manned carrier, made port safely.

Bottom left:—The veteran destroyer, Skeena, lies shattered on the rocks of Reykjavik Fjord.

Right:—In a bleak cemetery in Iceland are the graves of Canadians lost in Skeena's wreck.

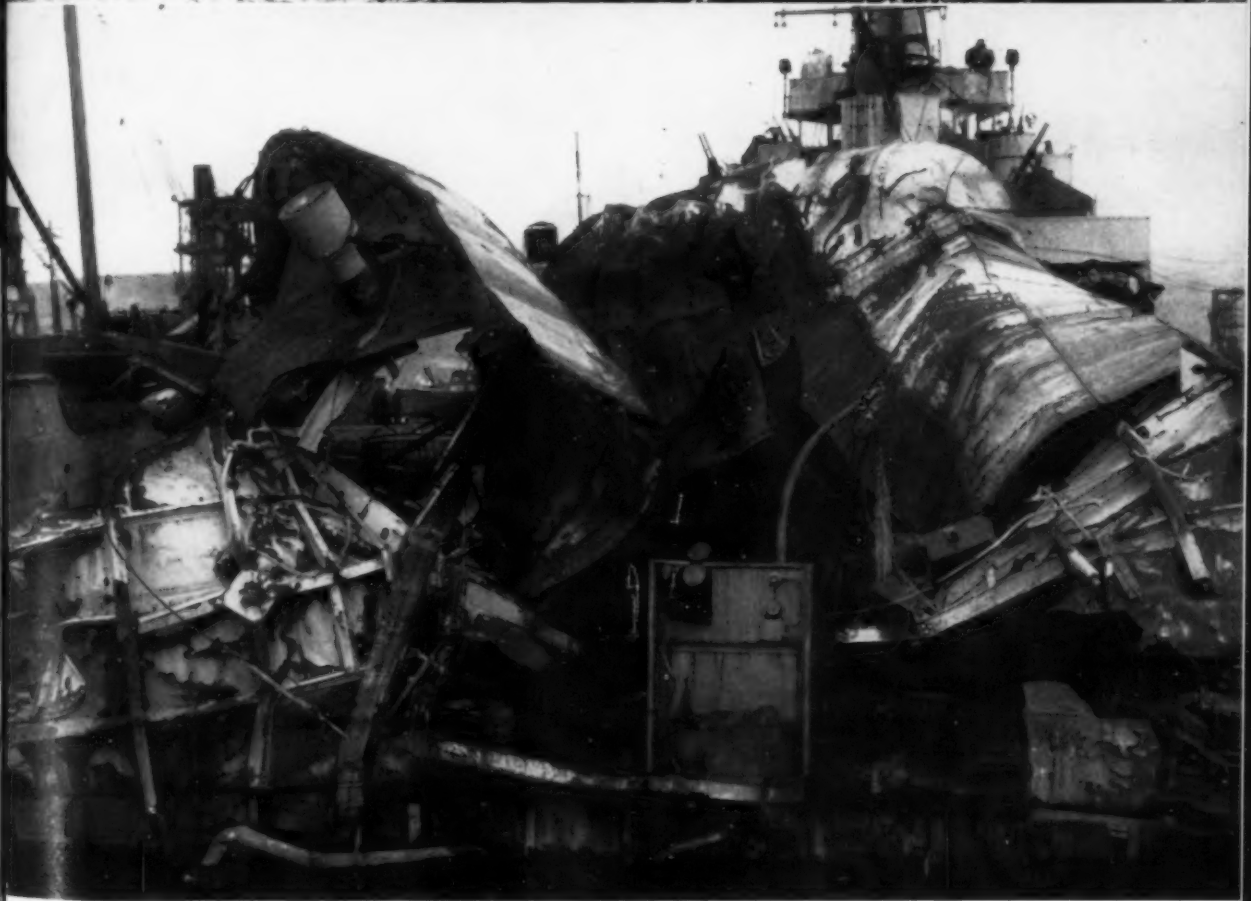




The day before Christmas, 1944, while millions of Canadians prepared for the season's festivities in the warmth of their homes, the 'Bangor' minesweeper, H.M.C.S. Clayoquot, was torpedoed and sunk off Halifax harbour with the loss of eight lives. Survivors are shown here alongside rescue ship, the corvette, H.M.C.S. Fennel.

Top right:—A German torpedo blew sixty feet from the stern of the Canadian frigate H.M.C.S. Teme, while she was on convoy duty in European waters. She is seen here after she has been towed safely to a British port.

Bottom right:—Forty feet of the stern of the frigate, H.M.C.S. Chebogue, was converted into mangled wreckage and seven lives were lost in a North Atlantic torpedoing. The crippled warship later survived a furious gale to reach a haven in Great Britain.



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In this time, too, another port was being developed. It is a popular sport to gibe at censors, and one (incidentally) usually indulged in by those who know nothing about the intricate "reasons why" of censorship. One of Canada's best censorship jokes was the famous "Eastern Canadian Port", which everybody took, as a matter of course, to be Halifax. The laugh, however, was in the end to a great extent with the naval censors, for the port of Sydney, Nova Scotia, was a considerable convoy assembly centre from 1940 to 1942, when the task of convoy assembly was moved to New York. Even to this day, few Canadians are aware of the very important contribu-

Souvenirs of a U-Boat kill by a frigate, H.M.C.S. Saint John, were the jacket and rubber life-raft shown above and the certificate at left commemorating the ten-millionth revolution of the German submarine's engines.

tion made by Sydney in the Atlantic campaign. In July of 1942, for example, one million, five hundred and sixty thousand gross tons entered the harbour, whilst, in 1943, the average number of convoys handled from this port was two per day! By 1945 there were forty naval units based on Sydney.

It was on May the eleventh, of 1942, that the first of the U-Boat attacks in the St. Lawrence River took place. The news came as a great shock to the people of Canada, although it was no particular surprise to the Navy. The men concerned with operations, and those actually taking part in operations at sea, knew only too well the tremendous under-water strength against which the battle was being fought.

In these days, it seemed as if not even the entry of the United States into the war were going to be sufficient to turn the tide now running against us with such speed and strength. The vast productive power of all North America had, it is true, now been thrown into the scales; but the problem still remained of using it effectively against the enemy. Productive power, everybody knew, would win, but *only if sea-power could bring it to bear*. The road to victory lay, as it had lain since the collapse of France, across the Atlantic.

The St. Lawrence attacks, disturbing as they were to the public mind, were very far from being the most serious problem facing the Navy. The coastal convoys still had to be protected, the ocean remained the vital battle-ground. The wise decision was taken not to weaken materially any of the escort forces already engaged farther afield. Additional patrols were instituted in the St. Lawrence, and escorts were provided from a fantastically slim reserve: but the job of holding the main sea-lines was not materially affected.

Meantime, the Navy grew. It grew in stature and performance, in numbers both of ships and men. It grew also in experience. It even, whilst still most heavily pre-occupied with its current savage struggle, moved forward in the matter of acquiring

larger ships whose primary job would not be fighting submarines. Arrangements were made to acquire or to build destroyers of the famous 'Tribal' class, which were to be so valuable and to gain laurels in the later stages of the war when, once again, and in another way, the paramount importance of sea-power was to be spectacularly demonstrated. *Haida*, *Huron*, *Athabaskan* and *Iroquois* were built for us in the United Kingdom, whilst at Halifax a building programme was initiated which called for the construction of four more ships of this class—*Micmac*, *Nootka*, *Cayuga* and the new *Athabaskan*.

In its quiet way, this was a significant step, for it emphasized the fact that it was not intended that the R.C.N. should remain indefinitely as an anti-submarine escort fleet.

The pattern of the Atlantic campaign was consolidated, in May, 1943, by the appointment of a Canadian officer (Rear-Admiral L. W. Murray, C.B., C.B.E., R.C.N.) as Commander-in-Chief, Canadian Northwest Atlantic. A similar command was announced by the R.C.A.F., with air and sea forces co-ordinated by the Naval Commander-in-Chief.

This, at one and the same time, laid stress upon the importance of the R.C.N. in the North Atlantic, and the part that the Air Force was now playing. The situation had, indeed, developed both in scope and seriousness far beyond anything that had been envisaged by either side at the outbreak of hostilities. It had become the crucial battle of the war, but not the only area in which Canadian ships were bearing their part in the struggle for control of vital waters.

A new phase of the war was opened by the great landings in North Africa. It is to the credit of the Navy that, when asked to supply escort vessels to take part in the job, it was able to send seventeen corvettes at a time when it was also doing close to half the total convoy-escort job in the North Atlantic—a far cry indeed from the tiny force of 1939!

Everybody knows how well those seventeen corvettes acquitted themselves, off-

When a group of Canadian warships damaged a U-Boat in the North Atlantic, a boarding party from the corvette, H.M.C.S. Chilliwack, tried to salvage her, but the submarine was so badly damaged that she soon sank.

setting their own losses with additions to the tale of U-Boats sunk, facing at times almost continuous air attack, carrying the good name of the R.C.N. farther afield than it had previously travelled. They came back, less two of their number, but with new laurels and were soon back on the seemingly unending game of Atlantic escort.

It had by now settled down to a fairly routine job. Indeed, the whole matter of the assembly, regular sailing, and escorting of the convoys had long since shaken down and was operating smoothly. It had, in fact, almost from the start operated well enough, the problems arising mainly from a lack of sufficient escort vessels. This lack was, of course, continuous in varying degrees throughout the long campaign, but it was by now noticeably reduced. Indeed, the entire situation, by the summer of 1943, had shown marked improvement. Escorts were more plentiful, merchant ships had been comparatively adequately armed, and considerable strides were being taken in the matter of new and very useful anti-submarine equipment.

Air-cover, too, had been greatly improved, it now being possible, by the use of bases in Newfoundland and Iceland, to cover the convoys in all but bad weather by means of large-range aircraft of the Coastal Command. This is not to suggest that the U-Boat war was over, for it was far from that: a measure of control, however, was in sight, and losses were being kept within bounds. The responsibility of the R.C.N. was steadily increasing, and its expansion continued at a rapid, yet well-groomed, pace.

A noticeable asset was the 'Wrens'. Starting in August, 1942, this most valuable addition to the Navy's personnel was eventually to rise to the figure of 5,947 officers and ratings, whose contribution to the manning of essential shore establish-



ments not only eased manning-problems at sea, but also rendered recruiting of men for numerous duties quite unnecessary. The Navy's women quickly outdistanced prejudice, cheerfully accepted naval discipline, and in countless ways made themselves all but indispensable to a war-time Navy engaged upon a most exacting task.

The change that had come over the whole situation by 1944—the Navy's big year—is scarcely credible. The one-time enthusiastic yachtsmen had by now become weather-beaten men, wise at their trade, fond of their ships, immensely capable and sure of themselves, and possessed of a quiet tacitly-understood tradition to which they held very true.



New equipment, relentless training and long (though often bitter) experience had welded together the once ill-assorted force into a service of great striking power in its special field. The U-Boat was not beaten, but the twilight was in sight, and he no longer ranged the seas at will and with impunity. Where once we had opposed him with courageous hunches, and the guess-work of good men with limited experience, he now had to deal with wondrously improved asdic, with up-to-the-minute radar, and with men whose study of anti-submarine tactics was taken with great seriousness. The field of anti-submarine warfare had become a specialist's job, and the R.C.N. was specializing with vigour and success.

Two additional factors, each most useful in its way, were now beginning to tell in the struggle.

With the combined British, American and Canadian building and training programmes gaining general ascendancy at sea, it was becoming possible to provide 'striking groups'. These were groups of frigates, corvettes or sloops (a class of escort vessel used in the Royal Navy, and similar to the frigate) operating as a hunting unit, and not attached to any particular convoy. It had often been found in the past that escort vessels accompanying a convoy would have to abandon a promising chase for fear of leaving the convoy exposed to attack from other U-Boats which might be in the vicin-

ity. This necessity had greatly reduced the effectiveness of counter-attacks by ships operating in close escort of convoys.

It is not generally appreciated how long and arduous a U-Boat hunt can be, but to bring about a certain 'kill' can occupy the full attention of several ships for many hours. An excellent example of this is furnished by the near-capture and final destruction of U-744 by His Majesty's Canadian Ships *St. Catharines*, *Chilliwack*, *Fennel*, *Chaudiere*, *Gatineau* and H.M.S. *Icarus*. This action actually lasted for thirty hours. Fifteen hundred radio telephone signals passed amongst the ships during this time, and two hundred and ninety-one depth-charges were dropped before the U-Boat was finally forced to the surface. When she did surface, *Chilliwack* happened to be the nearest ship. She fired ten rounds of 4" shell, 97 rounds of pom-pom, 480 rounds of oerlikon and 450 rounds of small-arm ammunition. Numerous hits were scored, but the U-Boat remained afloat long enough to be boarded and examined, and was finally despatched by a torpedo from H.M.S. *Icarus*.

The above story conveys some idea of how elusive and obstinate a submarine can be, and well illustrates the point made two paragraphs above. Six ships were used on the job, and it lasted 30 hours! To take six escorts from a convoy for such a length of time, during which the convoy might steam 300 miles, would be to invite disaster. The introduction of the striking group made possible much longer and more efficient hunts.

The second factor was the extreme value of the new air-cover supplied not only by shore-based aircraft operating from both sides of the Atlantic, and from Iceland, but also from the small escort-carriers which, by this time, were accompanying the convoys. U-Boats could no longer cruise surfaced on a course parallel to the convoy during

the daytime, closing in to attack at night. The danger of being spotted from the air, or by radar, was too great. It was these measures which compelled the use of the 'schnorkel' breathing apparatus enabling a U-Boat to cruise submerged for long periods.

They, together with the steady improvement in training, equipment, and quantity of the escort groups, were cutting the losses in merchant ships and increasing the losses to U-Boats in a manner which, as the months went on, began to show a positive and certain turning of the tide.

Even the quality of the ships improved, the building programme being converted steadily into one productive of the faster, larger and better-armed frigate. The make-shift, desperate days were definitely past. The fight was being conducted now by a Navy sure of itself, of high morale, well able to deal on level terms with the enemy.

Not that the enemy had, in any sense, ceased to be formidable. As the winter passed into spring, it became increasingly clear that the invasion of Europe was unlikely to be postponed far into the summer, and not unnaturally the effort to harass, and if possible cut, the vital North Atlantic artery of supply was redoubled. New devices appeared on both sides. The Germans had already successfully developed the acoustic torpedo—had, indeed, sunk three of our escort ships with this weapon in September of 1943, in addition to merchant ships. U-Boats with greatly increased underwater speed appeared, whilst their deck armament was considerably strengthened as a counter to the now somewhat ubiquitous aircraft.

On our side, radar was constantly being improved and late models being made available to the R.C.N. Depth-charges were increased in power, and other underwater weapons of greater accuracy than the depth-charge brought into play. The battle went



The German crew of U-190 had been at sea for many weeks before its surrender to H.M.C.S. Thorlock off Newfoundland, and their hair hung down over their jacket collars.

Once one of the scourges of the North Atlantic and now a prize of war, U-190 comes to a quiet mooring in St. John's.





Lieutenant-Commander John Douglas Maitland, D.S.C. and Bar, R.C.N.V.R., Vancouver



Lieutenant Thomas E. Ladner, D.S.C. and Bar, R.C.N.V.R., Vancouver



Lieutenant-Commander Cornelius Burke, D.S.C. and Two Bars, R.C.N.V.R., Vancouver



Lieutenant-Commander Thomas G. Fuller, D.S.C. and Two Bars, R.C.N.V.R., Ottawa



Motor torpedo boats and motor gun boats, manned by Canadians, pounced on enemy shipping with swift fury in the English Channel, the Adriatic Sea, and off the coast of Sicily. Steady nerves



Lieutenant Leslie R. McLernon, D.S.C., R.C.N.V.R., Montreal



Four Canadian motor torpedo boat ratings of Normandy are (left to right): Leading Seaman Glasgow Able Seaman Bill Dublack of St. C.



...shipping... hearts are needed to man these bucking broncos of the naval world. On this page are shown
...ady nerves... who commanded these fighting craft with deadly success.



*Lieutenant John William Collins,
D.S.C., R.C.N.V.R., Toronto*



*Lieutenant-Commander Charles
Anthony Law, D.S.C., R.C.N.V.R.,
Quebec*



*Lieutenant Malcolm Campbell
Knox, D.S.C., R.C.N.V.R.,
Montreal*



...the Distinguished Service Medal during the invasion
...t ratings... of Calgary; Able Seaman James Wright of New
...ading Seaman... and Leading Seaman Bushfield of Stratford.
...ack of St. C...



*Lieutenant J. R. H. Kirkpatrick,
D.S.C., R.C.N.V.R., Kitchener*



*Lieutenant Charles Arthur Burk,
D.S.C. and Two Bars, R.C.N.V.R.,
Toronto*



Few service shows have earned more praise than the Royal Canadian Navy's revue, "Meet the Navy"; in the above picture the King and Queen are seen backstage chatting with members of the cast following a command performance in London.

The chorus of "Meet the Navy" is pictured against a definitely naval backdrop.

An entertainer beloved by thousands of Canadians beams happily in the midst of Navy Show Wrens. It's Harry Lauder.



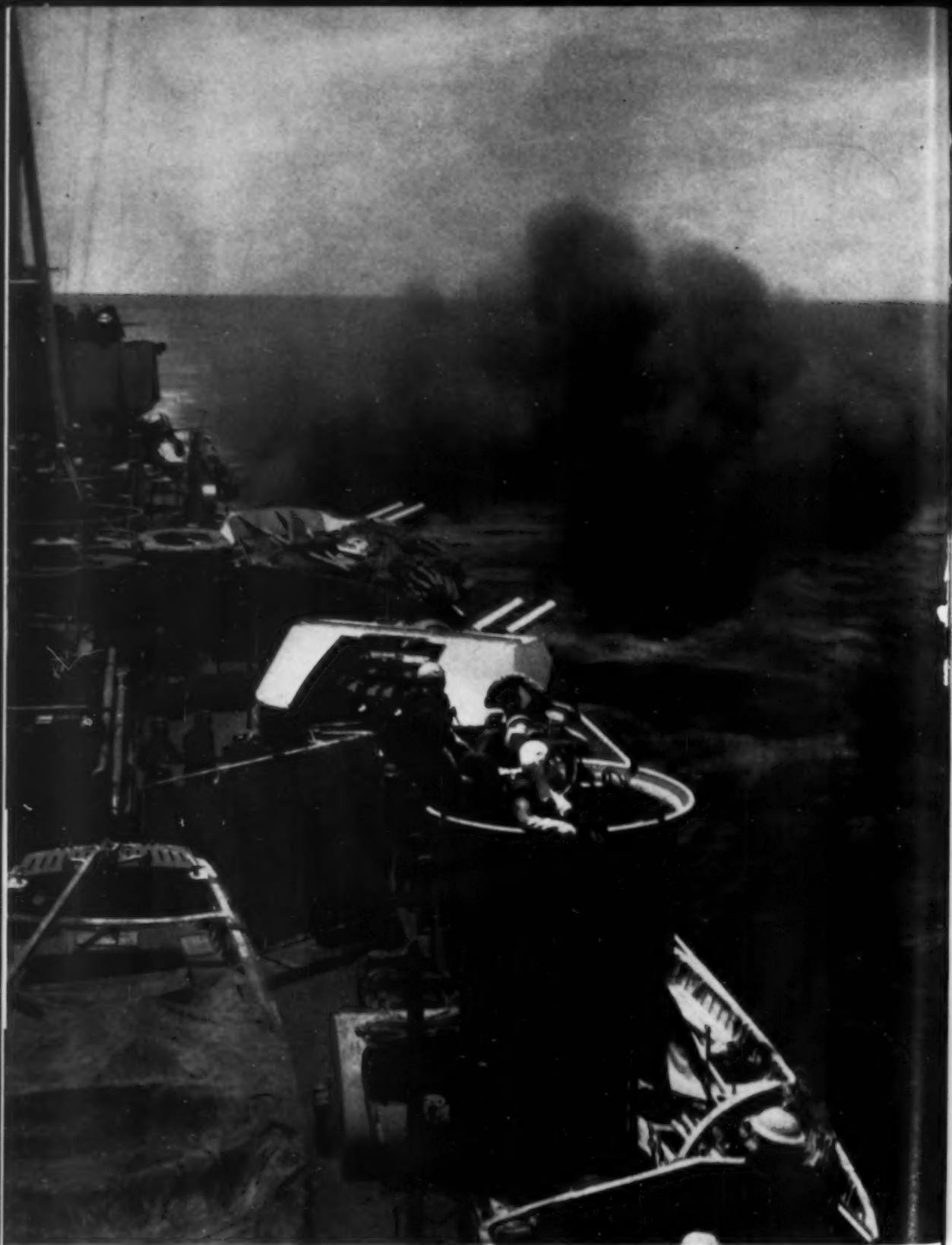


The sights and sounds of Paris intrigue Leading Wrens Gwen Tasse, of Toronto, and Rhea Smith, of Montreal—both with the Navy Show on the Continent.

Canadian troops queued up for blocks when "Meet the Navy" played in Brussels. Two extra matinees had to be given to accommodate the crowds.

Here is the charming "Meet the Navy" chorus line in a nursing sister number. The popular Navy Show is to be filmed in a picture which will include scenes of the Royal Canadian Navy's fighting ships in action against the enemy.





The Canadian cruiser, H.M.C.S. Uganda, spent four months in the Pacific battle zone with the British fleet, and is seen here as she took part in the bombardment of Sakishima near Okinawa. The smoke rolling out to sea is not from the guns visible here but from the two triple six-inch turrets on the forecastle.

on, less "ding-dong" than in the darker days, but no whit abated in its savagery.

Meantime, the planners had continued with their planning. The British-built 'Tribals' were ready, in commission and at sea. They had already begun to steam towards their laurels. The Navy was already moving towards the bigger ships with which it intended to join in the Pacific War. Two cruisers—*Uganda* and *Ontario*—would soon be joining the fleet. Two escort carriers (*Nabob* and *Puncher*) had been manned, apart from flying personnel, and were giving valuable experience to their ships' companies. Further, the matter of the great invasion was well under way. For this, a personnel of 10,000 officers and ratings had been allocated, together with over a hundred ships from landing craft to the 'Tribal' class destroyers. Amongst them were the motor torpedo boats.

The last-mentioned fought many actions in the English Channel and adjacent waters as the invasion period drew near, fifty-nine of their officers and over a hundred of their men having been trained in earlier days in the 'Fairmile' motor launches, the 'Maids of the Navy', which had done such sterling work in patrol, and a dozen other assorted duties, in restless northern waters and down in the Caribbean. The M.L.'s have received little mention, but had it been only for the experience and training they gave the M.T.B. crews, their use would have been fully justified. As it is, they undertook a thousand duties from escort and patrol to mercy trips, mine-disposal and recovery, carrying of mail and secret messages to vessels on patrol at sea, and undertaking the somewhat frightening role of 'submarines' in highly realistic training manoeuvres. In the whole story they should certainly not be forgotten.

Back in the Atlantic, the R.C.N., smooth-running, and very able now, achieved its crowning distinction in that fateful summer. With every possible craft needed in home waters, the British Admiralty entrusted the entire convoy-escort job of the North Atlantic trade convoys to the Canadians.

This, at one of the war's most critical periods!

The D-Day story has been told before (see *Canadian Geographical Journal*, November, 1944) and constitutes a noble chapter in our Navy's history. The wise decision, taken earlier, to acquire the 'Tribals' paid rich dividends in the night attacks on German shipping. The landing craft fell no whit short of the 'highest traditions of the service'. The M.T.B.'s fought hazardous, high-speed and successful actions almost nightly. And the big Atlantic job went on.

It was actually during this period—41 days after D-Day to be precise—that the famous 167-ship convoy already referred to (see page 206) left New York. If ever proof were needed of the effective mastery of the seas at this stage, this surely is it. Sea-power, backed by a huge air umbrella, had landed and supplied the troops in France. Sea-power in the Atlantic was now bringing further supplies without noticeable let up or hindrance. It is significant that the two largest items in the cargo of that convoy were "Oil—307,874 tons; other Military Equipment—251,297 tons". Many an R.A.F. pilot went to his target on that "oil": many a G.I. owed his life and ability to fight to that "other military equipment".

It was all guided and guarded on its journey by a Canadian frigate and six of our corvettes!

Nor, with the advance into Normandy and thence to the Siegfried line, did the U-Boat war cease. The U-waffe, tenacious, its personnel still convinced of German victory, often fanatically imbued with the fantastic doctrines which so nearly wrecked the world, remained a wary and dangerous foe. The twilight was falling, but it was still enlivened by the fires of active conflict.

From October of 1944 to the end of the war with Germany five more U-Boats fell victim to Canadian ships. These were the successful vessels:—

H.M.C.S. *Annan*

H.M.C.S. *St. Thomas*

H.M.C. Ships *Strathadam*
La Hullose
Thetford Mines

(The above three ships in co-operation with each other)

H.M.C.S. *Saint John*
H.M.C.S. *New Glasgow*

But it was a losing battle for the submariners now. The hulls of steel were well and truly ringed around the convoys, the bases into which many a U-Boat commander had sailed proudly, with sunken tonnage to his credit, and an Iron Cross as his anticipated reward, were lost or under heavy attack. The enemy's position was increasingly precarious.

Finally, the curtain fell. At its falling the little ships, born of the sleepless planning, the toil of the shipyards, and the first bold ventures of the 'tin-pot' Navy, rode the sea unchallenged.

What if a few unruly elements broke loose to besmirch the victory with their folly? Surely a fairer, truer memory is of the many who had fought the enemy, endured the hardship, won the unsought glory, and now smiled into each others eyes in half-believing joy? Or of the quiet men upon whose desks the midnight oil had often shed its light—the only light they knew in the darkest of the days.

The planning, the vision, the courage, had paid off. The difficult had been swiftly done each day throughout the war. The impossible had taken a little longer—but it, too, had been done.

Within a matter of days the first German submarine to surrender in the Western Hemisphere appropriately gave itself up to the first Western Hemisphere Navy to engage in the great fight by sea.

The end of the war in Europe was not, however, the end of the Navy's war. Plans laid long since for the R.C.N.'s part in the Pacific were maturing even as the U-Boat fight continued. These called for a fleet of sixty or so ships, widely different in its constitution from that used in the Atlantic. The cruisers *Uganda* and *Ontario* were already in commission, the former not far

from the threshold of fighting in the distant East. Arrangements had been made for the acquisition of two aircraft-carriers. The *Prince Robert*, rounding out her career as passenger-ship, armed-merchant-cruiser, and anti-aircraft-cruiser with a tropical refit in the latter guise, was soon to be ready to deal with 'kamikadze' pilots, or whatever else might befall. The three remaining 'Tribals' (*Haida*, *Huron*, and *Iroquois*) were to be joined in Eastern waters by the *Micmac*, fresh from a Canadian shipyard. Two others, more modern, of the Fleet 'V' class—*Sioux* and *Algonquin*—were to be in the flotilla. A second destroyer flotilla of the British 'Crescent' class—amongst the most modern ships afloat—was included in the plan. Finally, thirty-six of the newest of our frigates would complete the fleet.

For a one-time six-destroyer Navy which had turned itself, against great odds, into a highly specialized anti-submarine fleet, it was a considerable and far from discreditable undertaking. *Uganda* had already done her first tour of strenuous duty, *Ontario* and *Prince Robert* were on their way, and other ships were just about to leave when, from a base gained and held by American seapower in the Pacific, a heavy bomber dropped a bomb whose high-explosive weight shook the entire world.

It stopped the war.

It seems certain that it must also have revolutionized a thousand well-established beliefs and principles, and thrown all previous experience of war-making into a vast melting-pot of speculation. The truth is that, as these words are written, no man living knows the exact effect of this amazing development on sea warfare.

Despite this, however, certain facts remain true. One of these is that until the

Top right:—The anti-aircraft cruiser, H.M.C.S. Prince Robert, seen here at Vancouver, arrived in Hong Kong, shortly after the fall of Japan, with supplies for Allied prisoners.

Bottom right:—Canada's newest cruiser, H.M.C.S. Ontario, is seen here at Valetta, Malta, on her way to join the British fleet in the Pacific battle area.



The first 'Tribal' class destroyer ever built in Canada—as photographed on her sea trials following completion by her builders, Halifax Shipyards Ltd. Three sister ships are being built at Halifax.

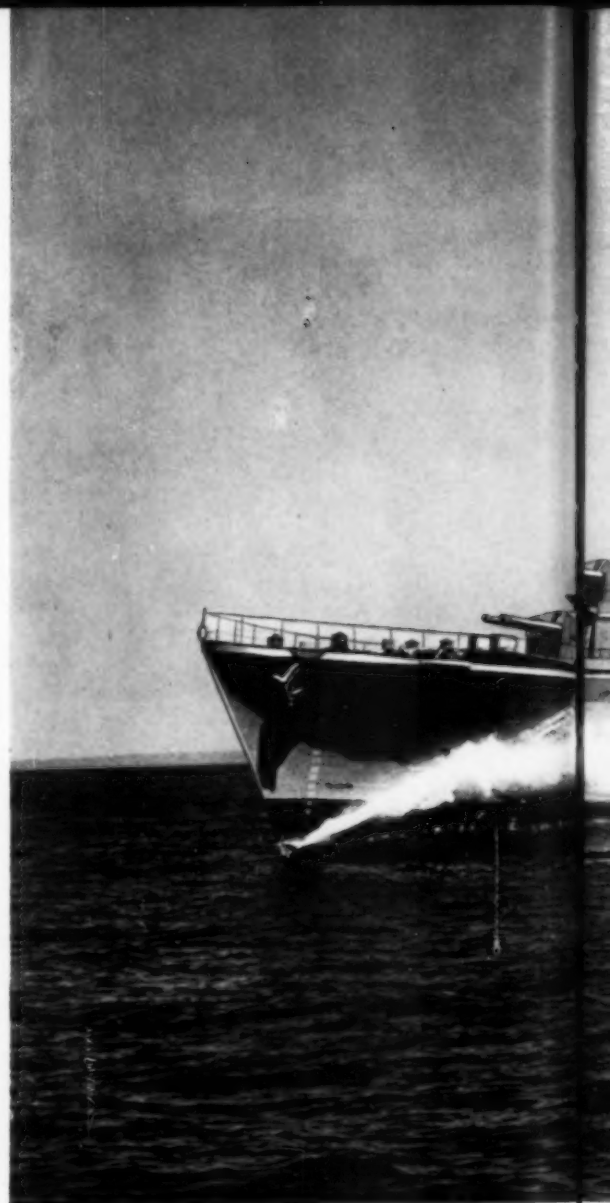
torpedo, the mine, the gun are rendered obsolete, they must be taken into intelligent account. Until the merchant ship is no longer required to ply the sea, the ability to protect the merchant ship remains a national obligation.

It is certainly true that, in all probability the Navy of to-morrow will be, in many of its aspects, an entirely different sort of Navy from that which we now possess. It is also true that to-day's Navy is entirely different from that of 1939. At this time, critical in the Navy's evolution which is largely dependent on the sound horse-sense of the average Canadian, it is of paramount importance that the public should realize that navies *do not appear overnight*.

With the high technical skill, the constant modernization made necessary by the advances of science, no Navy of the future could possibly hope to duplicate the long-term feat performed by the destroyers, corvettes, minesweepers and frigates of the R.C.N. in World War II. *There just will not be any long term!*

Past experience has shown us the dangers of relying upon others for our defence at sea. It is true that we never had to defend our coasts in the war just finished: but had we and our friends failed to defend the essential communication lines, thus keeping the war *from* our coasts, we would certainly have been unable to do so. Our defencelessness was for many critical months almost complete, but it was never completely exposed.

It could—and let this be remembered well—have been most thoroughly exposed at the whim of the German Navy's high command. A bombardment in force by submarines, or by larger surface craft, was for many months a distinct and disturbing possibility. It could have been carried out



with definite success had the German admirals willed it.

A prudent measure of naval defence can now only be maintained by the retention of a sound and solid permanent force, through which a steady stream of reserves can be passed, and whose permanent element will consist of highly trained, progressive-minded men well able to keep abreast of the swift tide of scientific change.

A force of this character cannot be maintained without ships, and ships that go to sea. To content ourselves, in a rapidly changing world, with a token force, starved



for manpower, fuel and opportunity of scientific development, would be to expose the country to inexcusable dangers. Further, it would jeopardize that heritage so magnificently, and so narrowly, protected by those whose courage, determination and sacrifice constitute the tradition of our defensive services as they stand to-day.

The record of the Royal Canadian Navy is now great. With extraordinary determination and tenacity, in circumstances of deep gravity, it has struggled forward to a position of which its owners—the people of Canada—may legitimately be very proud. It took a great share in holding the most

vital life-line of them all, and won distinction in a dozen other fields. All it asks to-day is to be so supported in the critical days ahead that, should the call to active duty be repeated, it may—in some infinitely swifter-moving war—once more uphold the right, protect the shores, and preserve our country's dignity and freedom.

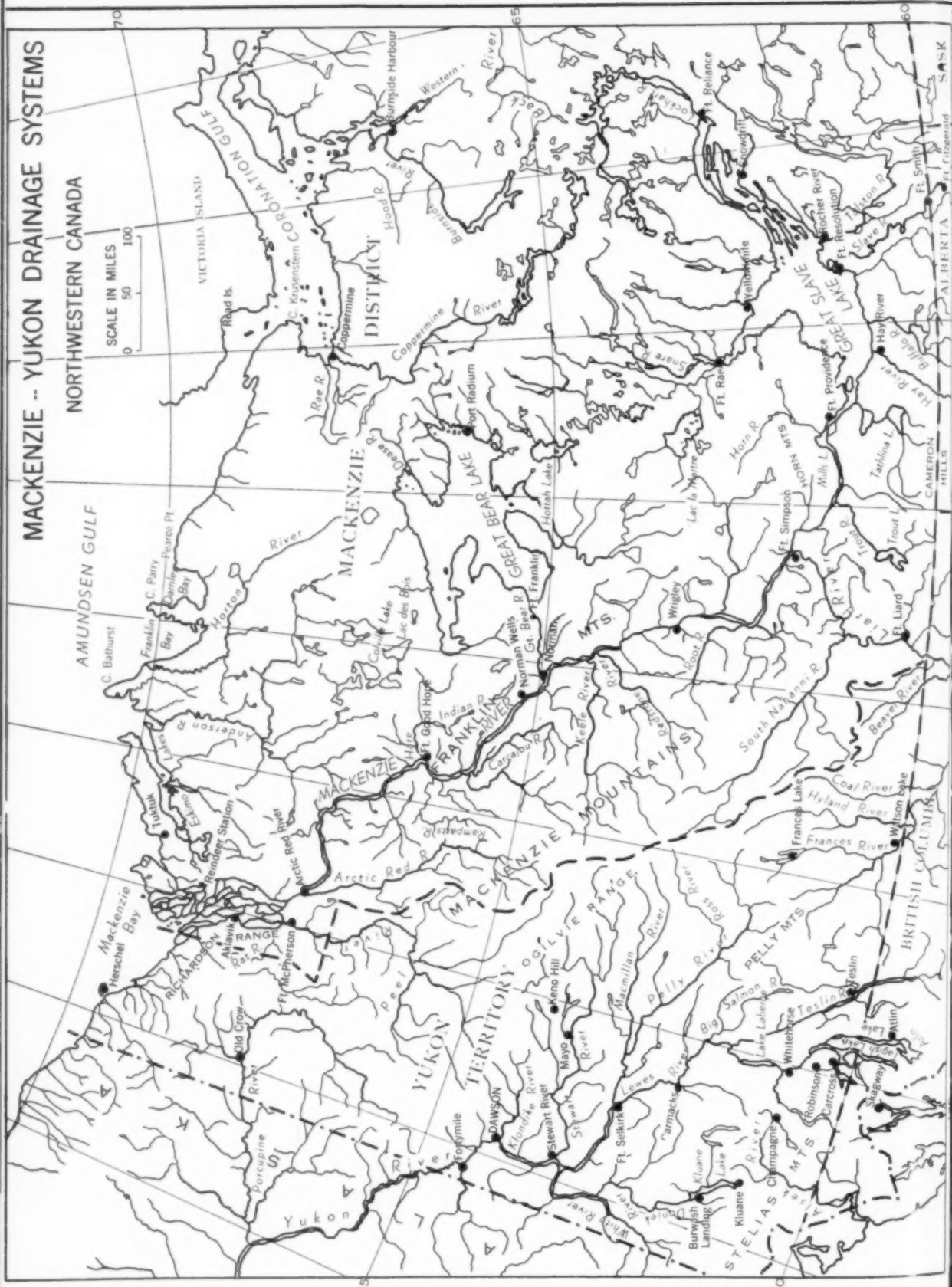
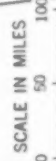
*For complete *Canadian Geographical Journal* record of the Royal Canadian Navy, see:—

1. Nov., 1940—"The Royal Canadian Navy, 1908-1940"
2. Nov., 1941—"Canada's Navy (1940-1941)"
3. Nov., 1942—"The Royal Canadian Navy, 1941-1942"
4. Nov., 1943—"The Royal Canadian Navy, 1942-1943"
5. Nov., 1944—"The Wonderful Year (1943-1944)"

(Copies of the above issues may still be obtained from *The Canadian Geographical Society*, Ottawa.)

MACKENZIE -- YUKON DRAINAGE SYSTEMS

NORTHWESTERN CANADA





Water Transportation in the Canadian Northwest*

by J. L. ROBINSON**

TRANSPORTATION is one of the keys to the future development of the Canadian Northwest. The exciting optimism of the present air age regarding northern air routes across the "top of the world" is apt to make one overlook the fact that northern Canada has two fine navigable water systems, the Mackenzie and Yukon, which have been carrying freight and supplies and opening up the country for over a century. Although new air and land routes will undoubtedly do much to facilitate development in Canada's Northwest, the bulk of heavy imports has always been most economically carried by water transport when available.

Both the Mackenzie and Yukon Rivers are broad and long and rank with the ten greatest river systems in the world. The series of rivers and lakes which makes up the Mackenzie waterway has a total length of 2,500 miles from the headwaters of the Finlay River in the Rocky Mountains (a length almost equal to the width of Canada), and drains a basin with an area of about 700,000 square miles (one-quarter of the mainland area of Canada). In North America the Mackenzie River system is exceeded in length and drainage area only by the Mississippi-Missouri system of central United States. Yukon River is 1,979 miles long from the headwaters of Nisutlin River in the Mackenzie Mountains (714 miles in Canada and 1,265 miles in Alaska), and has a drainage basin of 320,000 square miles (127,000 square miles in Canada).

According to the map, the routes appear to offer broad water highways to the Arctic Ocean or Bering Sea which belie the actual problems of navigation to be found. The fact that passengers can travel by comfortable steamer, with only one break, the entire 1,700 miles from Waterways to the Arctic

Ocean has probably contributed to many of the misconceptions concerning the character of the rivers.

For more than 150 years the Mackenzie River and its tributaries have been carrying the traffic of the fur trade, and also, in recent years, that associated with mining and other developments in Mackenzie District. In the Yukon the story of transportation is inevitably linked with the historic Klondike strike and the gold-mining industry of the Territory. Despite the general familiarity of Canadians with these broad facts, there still remain many hazy ideas as to the actual character and possible utilization of our northern rivers. A careful analysis of certain geographic factors can help in forming a background to an understanding of the role of water transportation in this area.

HISTORICAL BACKGROUND

Canadian settlement westward was led by explorer-traders who, following the major river systems, pushed farther and farther into the Northwest to tap the source of furs for their respective companies. In 1778 Peter Pond found the famous La Loche (Methye) Portage, which extended from the headwaters of Churchill River to Clearwater River, one of the sources of Mackenzie River. In 1789 Alexander Mackenzie made his historic journey northward from Fort Chipewyan on Lake Athabaska, and explored the mighty river now bearing his name to its mouth on the Arctic Coast. In the following decades fur-trading posts, serviced by birch-bark-canoe brigades, were established northward along the Mackenzie and its tributaries.

Around 1826 canoes were generally replaced by larger York boats, which carried greater amounts of freight and were better suited to transport on the larger rivers. The distinctive York boat was a shallow-draft vessel of 40-foot length, 10-foot beam, and shaped like a whale-boat with sharply

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**Photos by the author unless otherwise credited.

angled stern and bow. It carried both oars and a square sail, but was usually "tracked" upstream, the crew walking along the shore and pulling a line attached to the boat. During the greater part of the nineteenth century York boats carried most of the freight to the Mackenzie Valley from York Factory on Hudson Bay via the Hayes, Saskatchewan, Churchill and Clearwater Rivers to the regional distribution centre at Fort Chipewyan. ⁽¹⁾ From there they drifted northward to the Mackenzie River and downstream as far as Fort McPherson, the Hudson's Bay Company's most northerly post at that time.

The introduction of steam-power changed water routes in the Northwest. The first river-steamer reached Edmonton in 1875, following the North Saskatchewan River, and in 1886 a wagon-road was built northward from Edmonton to Athabaska Landing on the Athabaska River. ⁽²⁾ The 12-mile La Loche Portage, over which generations of voyageurs had toiled, then shared importance with the Athabaska River route, but both it and the Saskatchewan River steamer route fell into disuse after 1891 when the railroad was extended from Calgary to Edmonton.

About the same time the type of river transportation in the Mackenzie Valley underwent a radical change. In 1884 the steamer *Grahame* began to operate from McMurray, at the junction of the Clearwater and Athabaska Rivers, to Smith's Landing (now Fort Fitzgerald). ⁽³⁾ Northward-bound freight was then unloaded and hauled through the bush around the 16-mile rapids in Slave River. In 1885-86 Captain Smith built the steamer *Wrigley* at the north end of the portage (now Fort

Smith), and in the next year it began service northward to Fort McPherson. In 1887 the first stern-wheeler started to carry freight on Athabaska River from Athabaska Landing to Grand Rapids, and from there river-scows (as many as 100 in a single year) floated downstream to McMurray and Fort Chipewyan, where they were broken up for lumber.

Modes of transportation remained generally unchanged on the Mackenzie system for many years thereafter. In 1902 the steamer *Mackenzie River* became the first stern-wheeler to operate on the lower Mackenzie, and it was well able to carry all the supplies needed for northern posts.

A new period began in 1912, when the railroad was extended from Edmonton to Athabaska Landing, superseding the wagon-road. The year 1914 was the last for the Athabaska scow-brigades, for in 1915 the railroad was continued to the town of Peace River. Trade then started to flow via the Peace River instead of the Athabaska. The former is a slightly larger river, and has only one break in navigation — Vermilion Chutes, a 14-foot fall about 300 miles below the town of Peace River. Stern-wheeled steamers began plying the Peace above and below the Chutes, while a 4½-mile wagon road carried freight between the steamers. ⁽¹⁾

Peace River was the gateway to Mackenzie Valley for only a few years. The railroad from Edmonton again pushed northward into "bush country", and in 1921 reached Clearwater River about 8 miles east of its junction with the Athabaska River. ⁽⁴⁾ In 1925 it was extended to the present site of Waterways, 3 miles from McMurray. After this last extension the modern period of development began in the



Drainage divide in the Mackenzie Mountains between Yukon and Mackenzie tributaries

R.C.A.F. photo



Northwest Territories, with freight moving by rail to the northern terminal at Waterways and thence by river-steamers to northern settlements.

Water transportation on Yukon River extended upstream from Bering Sea and the Alaskan Coast. Although the early explorers used canoes and hand-made lumber boats to travel downstream, the first steamers worked their way inland from St. Michael near the delta mouth of Yukon River on Bering Sea. The small stern-wheeler *Wilder* was taken north in 1866, and is believed to have been the first steamer to operate on the river. Yukon Territory was entered in 1871, when the steamer *St. Michael* pushed upstream as far as Fort Selkirk. ⁽⁵⁾

As traffic and freight increased, the trading companies using the Yukon added newer and larger boats, but in 1897 it was reported that only two ocean-going vessels discharged freight and passengers at St. Michael and that five river steamers were serving the needs of Dawson and vicinity. ⁽⁶⁾

River traffic boomed when gold was discovered on the Klondike. In 1898 twenty vessels carrying gold-seekers navigated Yukon River as far as Dawson, and additional boats were constructed or assembled during the summer at Alaskan ports. ⁽⁷⁾ Frantic-

ally hurrying gold-seekers, however, demanded a shorter route to the Yukon placer wealth instead of the long trip through the Aleutians, Bering Sea and up the Yukon River. In August, 1898, construction was started on the White Pass and Yukon Railway from the port of Skagway, Alaska, to Whitehorse, Yukon, following a route over which prospectors had climbed the preceding year.

The railroad crossed the steep mountains and reached Lake Bennett in 1899, where small steamboats and other boats of all sizes and descriptions were constructed to carry freight and passengers to Carcross at the north end of Lake Bennett. Many of the boats continued down Lewes River and shot Miles Canyon and the White Horse Rapids south of Whitehorse. In August, 1900, the railroad was completed to Whitehorse and steamer service was established from Whitehorse to Dawson. In the following years most of the traffic entered Yukon Territory via this shorter and faster passage. The White Pass and Yukon Route, including one of its subsidiaries, British Yukon Navigation Company, built up an efficient transportation service, which became virtually a monopoly to the mouth of the Yukon River.

Left:—White Pass and Yukon Railroad beside Lake Bennett

W.P.&Y.R. photo

After completion of the Alaska Railway from Seward to Fairbanks in 1922, the British Yukon Navigation Company relinquished its business on the lower Yukon River to a United States Government-owned line of river-boats. In turn, the latter agreed not to operate vessels up-river from Tanana, Alaska, into Yukon Territory. Since that time the Canadian company has maintained large river-steamers, barges, and gas-boats on the Lewes, Yukon and Stewart Rivers, carrying the freight and passengers of the Territory.*

MACKENZIE RIVER WATERWAY

The great basin of the Mackenzie River is surrounded by a variety of topographic features. (8) On the south the level plateau country north of Edmonton is the only divide between the waters of the Saskatchewan, which flow eastward to reach Hudson Bay, and those of the Athabaska River, which ultimately empty northward into the Arctic Ocean. To the southwest the numerous headwater streams of the Athabaska and Peace Rivers have their sources within the high ranges of the Rockies. The barren jagged peaks of the Mackenzie Mountains form the divide between the central west tributaries of Mackenzie River and the eastern headwaters of Yukon

River. Tributaries are not so well defined on the eastern side of the Mackenzie Basin, where waters drain haphazardly from the rocky hills of the Canadian Shield. The whole region lies within an area of low annual precipitation (10 to 14 inches), so that low water-levels should be expected, and do occur, during the autumn.**

Climatic conditions limit the period of navigation on the Mackenzie waterway to about four months. Owing to the great latitudinal extent of the river system, there is a difference of about three weeks between the time when southern tributaries are usually ice-free in early May and when the Mackenzie delta channels break up at the end of May. Long periods of record at Simpson, Norman and Good Hope show that the average date of break-up in the Mackenzie at these places is May 15, with May 8 being the earliest date recorded and May 30 the latest.

The large bodies of lake water are slower in breaking up in the spring, and are, therefore, the delaying links in the chain of navigation. The ice does not break away from the shores of Great Slave Lake until early in June, and a period of about two weeks follows during which winds move the ice around in the lake. Clearing is rapid or slow depending on whether winds break up the floes and blow them towards the outlet or, more likely, the prevailing westerly or northerly winds hold the ice against the south shore until much of it melts. Ice remains longer in the eastern part of Great Slave Lake, generally not breaking up until late June, owing to the large number of islands there.

The streams tributary to the Mackenzie River are free of ice first, and in breaking up loosen the ice of the main river. Of prime importance to early navigation is the fact that the Liard River thaw comes in late April or early May, with the middle Mackenzie breaking up about ten days later and making a route to the northern posts available about six weeks before Great Slave Lake is open for through traffic. The northern tributaries, Arctic Red and Peel,



*Historical information supplied by C. J. Rogers, President of the White Pass and Yukon Route.

**For precipitation graphs of Mackenzie District, see the *Canadian Geographical Journal*, July, 1945, p. 39.

*Aerial view of
Athabaska delta*
R.C.A.F. photo



usually break up during the third week of May, and the lower Mackenzie follows about a week later.

In the autumn, ice starts to form along the shores late in September, and by mid-October drift-ice appears in the lower river. ⁽⁹⁾ Since the river-boats are usually wintered near Fort Smith, the last south-bound boat tries to leave Aklavik early in September to be back at the southern terminal by early October. In years of exceptionally heavy traffic, as in 1942, some of the boats freeze in on the lower river through risking additional late trips.

Final freeze-up comes in late October in the delta area, middle November on the upper Mackenzie River and late November on the southern tributaries. Great Slave Lake freezes over during December, but is usually not safe for tractor traffic until January. It has been suggested that the frozen Mackenzie route would make an excellent winter road, but the difficulty lies in the fact that the river usually freezes over "rough". Freeze-up comes when the ice-floes gradually get thicker and larger and finally join together. Only if a sudden drop in temperature freezes the river before

the blocks join will a section freeze smoothly and make an excellent road for dog-team travel.

The Mackenzie waterway consists of a series of lakes and rivers. ⁽¹⁰⁾ From McMurray onwards the Athabaska is a smooth and broad river, with an average width of 1,800 feet, an average current of 3 miles per hour, and a grade of about 8 inches to the mile. The river has cut its way into the plateau surface so that its banks are about 300 feet high at McMurray; they decrease northward, and are at water level where the Athabaska delta joins Lake Athabaska. Navigation through Athabaska delta necessitates careful piloting, owing to the continual silting and shifting of several branching channels. (See map p. 240.)

The Athabaska delta area is at present one of the most serious impediments to northern water transportation and an example of how geographic conditions have determined the type of transport craft used on the waterway. Although Athabaska River has a generally deep channel, boats must be designed to operate in depths of as little as 3 feet in the delta, where even lower water often occurs in the autumn. Shallow-draft,



Left:—River-front and wharves at Fort Smith

Right:—One of the wide meanders in Slave River. Note how the trees within the bend mark former channels.

flat-bottomed river-boats of the present type are generally able to pass this bottle-neck, but even they may be held up for several days in spring awaiting higher water, and sometimes have been unable to return to Waterways in the autumn when levels drop again. The Dominion Government was constructing a dredge in this area in 1945 to try to keep a channel open to combat the natural geologic process of delta-formation.

Lake Athabaska, the southernmost of the three great lakes in the Mackenzie Basin, is about 200 miles long, with a greatest north-south width of 35 miles. Water in the eastern end is clear and deep, but the western section is shallow and turbid as a result of continual silting. River-craft must navigate far into the lake to skirt these shallows, risking another danger—the possibility of rough water when the wind is from the east or north. The flat-bottomed

barges and river-steamers are vulnerable to such storms, and experience has taught captains to wait at the mouth of the Athabaska for good weather.

There are several channels draining the western end of Lake Athabaska, but the main one is Rivière des Rochers, which meanders northward for 30 miles before joining Peace River. Rochers River has a small rapid about 20 miles north of the lake during periods of low water on the Peace, but this normally causes no difficulty. North of the junction of the Rochers and Peace the combined waters are known as Slave River. From Peace River to the head of the rapids at Fort Fitzgerald the Slave is a broad deep stream from 1,800 to 3,000 feet wide with no navigation hazards.

Within the 16-mile stretch from Fort Fitzgerald to Fort Smith, the Slave is broken by a series of dangerous rapids which drop a total of 125 feet. Since supplies were



Left:—Drow River

Right:—road Fitzg Smith

front
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first shipped into Mackenzie District, they have always been portaged around these rapids. With provincial and Dominion help the ox-cart trail on the west side of the river was developed into a road suitable for motor traffic, and in 1931 private interests undertook maintenance of the road in return for a franchise on transportation of passengers and freight. A second portage road, generally paralleling the first, was constructed by another company in 1934, and has been owned by the Dominion Government since 1944. Both roads were improved, maintained, and linked by short connecting roads by the United States Army Engineering Corps during 1942-44.

Fort Smith is located about a mile north of the Territorial boundary (60 degrees latitude). ⁽¹¹⁾ Its present importance is derived from its position at the head of navigation for steamers and river-craft operating on the lower Mackenzie River

system. From Fort Smith water transportation efficiently moves most of the freight of Mackenzie District—not without difficulties and hazards—as far as the Arctic Coast, 1,400 miles to the north, and across Great Slave Lake to the large mining settlement at Yellowknife.

Below the rapids, Slave River follows an easy meandering course to its delta at Great Slave Lake. Minimum channel depths of 5 feet are found, but the river is generally much deeper. The winding river has a length of 200 miles for an air-line distance of 100 miles, and at “le grand détour” follows a curve of 16 miles to advance a half-mile. Because the current of the Slave is faster than that of the Athabaska, and carries less sediment, Slave delta is not being built out rapidly. The several channels are fairly well defined, but are usually buoyed each year by the Department of Transport.

*Left:—Rapids of the
Drowned in Slave
River at Fort Smith*

*Right:—The portage
road between Fort
Fitzgerald and Fort
Smith*



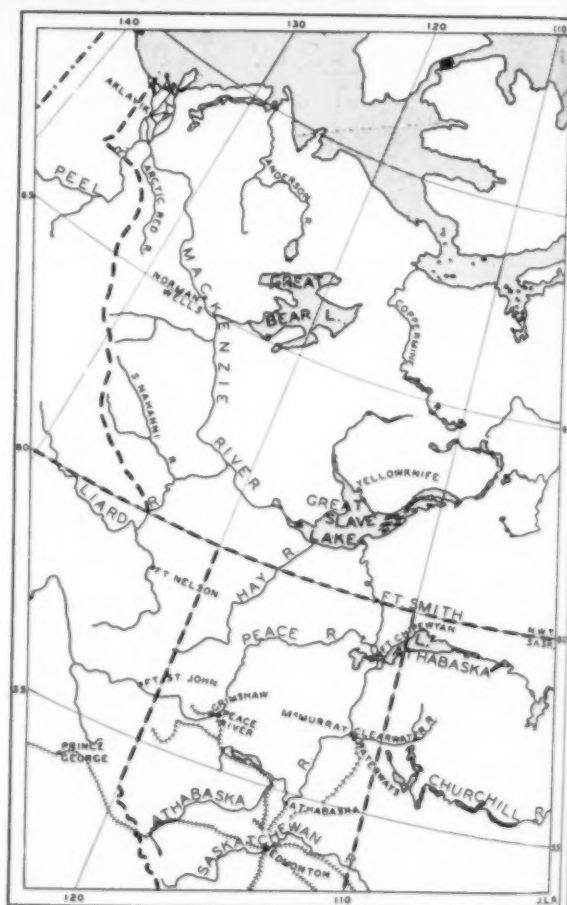


Looking south over the most branching channels of Slave River delta.

Great Slave Lake is the fifth largest in North America, being greater than either Lake Erie or Lake Ontario. (12) The eastern arm of the lake is very deep in places (1,000 and 1,440 feet have been recorded), and is a scenic area of numerous islands, peninsulas, and channels, coloured by steep red cliffs and deep blue water. Depths of 100 feet are average in the north arm of Great Slave Lake, but water becomes shallow at the northern end, and lake-boats deposit their cargoes several miles from Fort Rae. The central part of the lake averages 200 to 500 feet in depth, but the western section is fairly shallow throughout, especially along the south shore.* At Fort Resolution it was necessary to build a long wharf into the lake to enable supply boats to unload their cargoes, but at Hay River settlement the current of Hay River has maintained about an 8-foot channel, deep enough for the shallow-draft steamers.

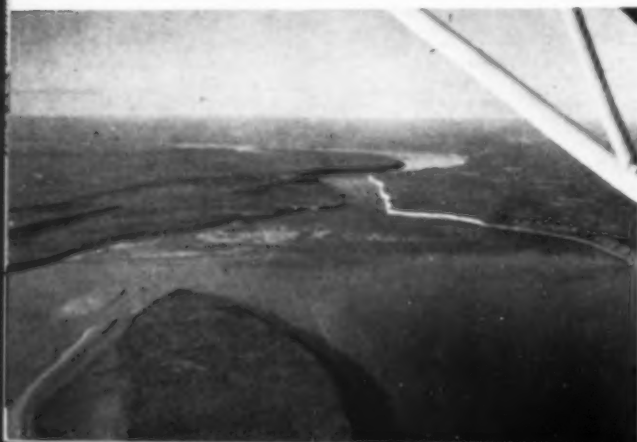
One of the popular misconceptions has been that these great lakes in the Mackenzie Basin offer a peaceful respite from the

*Charts of the lake and river are prepared by the Hydrographic and Map Service of the Department of Mines and Resources.



hazards of river navigation, whereas actually they present one of the chief problems. (13) Although the upper Mackenzie and Slave Rivers are free of ice about mid-May, traffic cannot move until mid or late June, when the ice in the lake finally breaks up. In addition to delaying the opening of navigation, the lake can have rough water

Looking north at the Ramparts in Mackenzie River.



g source of Macken-
the most River draining
ing channels Great Slave Lake.
f Slave drift-ice is leav-
ing the lake in
delta. mid-June.



during the summer, which forces steamers to tie up for several days in Slave delta awaiting calm water to cross the 110-mile stretch to the head of Mackenzie River.

Mackenzie River is fairly wide at the western end of Great Slave Lake, but is split into several channels by numerous low islands. The deepest water is found south of Big Island, where a shelter at Wrigley Harbour is often used by the river-boats. During bad weather, barges are left here while the boats shuttle across the lake to pick up other barges left on the south side.

The main river narrows near Fort Providence, about 45 miles from Slave Lake, and fast water about 6 miles east of the settlement calls for expert piloting. This section is a more serious problem on the upstream journey, when the frequent inability of boats to push all their barges against the current necessitates their making several trips through the narrows to take the barges singly.

Mills Lake is a broadening of the Mackenzie west of Fort Providence, but farther westward the river again narrows to about a mile in width. (14) A stretch of 70 miles east of Fort Simpson has fast water in which the most serious hazard is Green Island Rapids, 12 miles from Fort Simpson. The rapids, which have plagued river captains for many years, are the result of glacial boulders in the channel. Each winter and spring the ice moves these boulders so that every year a new channel must be found and buoyed on the first northward trip. This section was charted by the Dominion

Hydrographic Service in 1945, assisted by officers of the Department of Public Works, and a new 7-foot channel was found in mid-stream.

At Fort Simpson the Liard, a large river in itself, joins the Mackenzie from the southwest. Its load of silt is added to those of the smaller northward Mackenzie tributaries which drain the mountains flanking the lowland valley north of Camsell Bend. As a result, numerous long low islands, shifting sand-bars and glacial boulders necessitate careful navigation from the experienced river-pilots and captains. At Berry Island, for example, where the channel follows a narrowing between the island and the east bank, the current is not fast and boulders on the bottom cannot be detected. Boats usually drift through this section slowly, but, despite caution, several barges have been wrecked or punctured.

The cold clear water of Bear River empties into the Mackenzie from the east at Fort Norman, and at Norman Wells the Mackenzie is a mighty river 4 miles wide. South of Fort Good Hope two more serious obstructions impede through-transportation.



One of the many scenic branching channels in Mackenzie delta near Aklavik

At Sans Sault Rapids the river tumbles over a rock reef which is quite dangerous in low-water periods, but covered during high water. The Ramparts is a picturesque narrowing where the river passes through perpendicular limestone cliffs 100 to 150 feet high. There is a drop of 20 feet in a distance of about 7 miles, but the rapids are fairly deep, and the hazard lies in the 6 to 7 miles per hour average current.

The most serious navigation difficulty of the Sans Sault and Ramparts rapids is met on the upstream trip. If the water is high (as in early summer), Sans Sault rapids are covered, but the current in the Ramparts may be too strong for the river-boats, and they often have to pull themselves through by cables from the deck attached to shore. In the autumn, when water is low, the Ramparts can be navigated without help, but the Sans Sault Rapids become almost impassable.

North of Fort Good Hope there are numerous shifting sandbars, and the channel meanders back and forth across the slowly-moving river. At Point Separation the Peel River joins the main waterway and both

ivers split up into a great number of streams and channels which wind their tortuous ways through a low lake-dotted delta.

The Mackenzie delta is over 100 miles long and fans out to over 50 miles in width. Three or four main channels are used by the river-boats, and some of the others have enough water for Arctic coastal schooners, but none are deep-water channels. The most serious delta problem met by the present transport companies is provided by the meandering channels, which often result in much lost time when the boats and barges cannot swing around the sharp bends without stopping, backing and manoeuvring.

The present northern terminal for river transportation is on the Arctic Ocean at Tuktuk (Port Brabant), slightly to the east of the delta mouth. River-steamers wait at Kittigazuit, at the mouth of East Branch, for calm weather before entering the open coastal waters. Since the water is shallow at the river mouth (5 feet) and across the bay to Tuktuk, captains usually try to leave on high tide (only about 18 inches), and even then the stern-wheelers can make very little speed in the shallow water.

The preceding description of the Mackenzie River route is not meant to be a guide for navigation. Its purpose is to sketch natural conditions and problem areas found along the river so that Canadians may know more about the possibilities of this northern route, and to illustrate river and lake conditions which govern the design and type of present-day craft. Although the Mackenzie system is a deep and broad waterway for most of its length, the controlling navigational factors are the low-water areas. Vessels, therefore, must be designed to proceed through both shallow river water and rough lake swells, and also be powerful enough to push upstream against a 6-mile current.

MACKENZIE RIVER TRIBUTARIES

Water transportation possibilities are not limited completely to the main Mackenzie waterway, for the chief tributary streams also contribute to the present system.

Picturesque Virginia Falls (316 feet) on South Nahanni River, a tributary of the Liard.

R.C.A.F. photo



Peace River is a navigable river along most of its length, and steamboats once operated on it continually. The commercial practicability of this route is limited by the 14-foot fall 50 miles east of Fort Vermilion. At present one small motor vessel operates on the central part of the river between Peace River settlement and Vermilion Chutes.

Almost all of the rivers draining into Great Slave Lake have falls or rapids along their routes. Hay River drops over an escarpment which parallels the southern shore of Great Slave Lake, forming picturesque Alexandra Falls (109 feet) and nearby Louise Falls (50 feet) about 30 miles from its mouth. Taltson River, with numerous rapids and falls, is typical of most of the streams draining the rocky Canadian Shield. One of the scenic sights of the river is Twin Gorges Falls (90 feet), about 30 miles northeast of Fort Smith. Lockhart River drains Artillery, Aylmer and Mackay Lakes into the eastern end of Great Slave Lake. The river is a potential power site with three large falls (Tyrrell—85 feet, Parry—130 feet, Anderson—40 feet) within 15 miles of its mouth, and has been investigated by the Dominion Water and Power Bureau. A portage through a line of lakes south of Lockhart River is used as the canoe route to Artillery Lake and the Barren Grounds. ⁽¹²⁾ The rough, unnavigable rivers draining the multitude of small lakes into the north arm of Slave Lake (e.g., Yellowknife and Snare) are of similar character, having many rapids but no large falls. Investigations started in 1945 on the Snare River may enable a power site to be developed for the town of Yellowknife 75 miles away.

Liard River joins the Mackenzie at Fort Simpson and has its headwaters in the mountains of southern Yukon and northern British Columbia. The key importance of this river is due to its ice breaking up in early May, more than a month before Great Slave Lake is ice-free. By using the Liard route, the first supplies of the year (including very popular fresh fruit and vegetables) may

be brought to the settlements of the lower Mackenzie much earlier, and at a time when spring beaver and muskrats are being traded at the stores. The potential value of this route has been further enhanced by the Alaska Highway, which passes through Fort Nelson, British Columbia, allowing freight to be trucked from the railhead at Dawson Creek, and thence down the Nelson and Liard Rivers in small boats.

During the past two years a few of the trading companies have pioneered the Nelson-Liard route by sending a small tonnage of supplies downstream during high water immediately after break-up. Prior to this time freight for Fort Liard was shipped upstream from Fort Simpson. The chief disadvantage curtailing the future of the Liard waterway is the fact that it is a mountain-fed river which has a rapid run-off in the spring, and by August water is too low for successful navigation. The Liard River has an advantage and disadvantage in its early break-up and source of headwaters; which of these will weigh more heavily in future development is yet to be decided and will be influenced by the degree of success of the new Grimshaw-Hay River road to Great Slave Lake.

Bear River has been used since 1934 as an important water route carrying heavy tonnages of pitchblende ore from the radium mine on Great Bear Lake. ⁽¹⁵⁾ Unfortunately, the river has a series of impassable rapids about 30 miles from its mouth which had to be by-passed with an 8-mile portage road. Freight has been carried from the portage road by flat-bottomed river-boats to the head of Bear River, where it is again transferred to larger lake-boats for transportation across Great Bear Lake. Since upper Bear River has an intricate channel, the portage road is being extended eastward from Bear Rapids along the south side of the river to the lake, and, with the completion of the road in 1946, the second unloading will be eliminated.

Arctic Red and Peel Rivers enter the Mackenzie near its delta. The Peel is navigated without difficulty as far as Fort

McPherson but no commercial use southward has been made of either river. Indian schooners proceed from 50 to 100 miles up both rivers, but the practical value of the streams is curtailed by numerous uncharted sandbars and low water in the fall.

WESTERN ARCTIC COAST

A study of water transportation in the Canadian Northwest could not be complete without briefly outlining conditions which are met beyond the Mackenzie River along the Arctic Coast.* Because this area appears on the map as open ocean, there are many misconceptions as to present type of craft, amount of traffic and future possibilities.

During the later part of the last century the coast from Point Barrow, Alaska, to Herschel Island was much frequented by whalers who sailed in deep-sea vessels and often wintered in the area. Vessels of 17-foot draft could moor alongside the beach at Herschel Island. After the disappearance of the large whales this traffic gradually died out. Within the modern period some of the Arctic traders have brought vessels through the ice-floes to their northern posts, and, from 1925 to 1931, the Hudson's Bay Company had their large 1,300-ton ice-breaker *Baychimo* supplying their posts as far eastward as Cambridge Bay. Since its loss in the ice in 1931 no large ship has plied

*More detailed information may be obtained from *Canada's Western Northland*, pp. 35-39.

Lady Richardson, belonging to an Arctic coastal trader, and Bonnie Belle, an Eskimo schooner, at Aklavik.

these waters; the trade has been left to smaller, and more efficient, coastal schooners. After 1936 the Alaskan route ceased to be used except by the historic R.C.M.P. schooner *St. Roch*, and once by the H.B.C. schooner *Fort Ross* (transferred from the Eastern Arctic via the Panama Canal).

Uncertainty of ice conditions was the chief reason for abandoning the coastal route for the more dependable Mackenzie waterway. The Arctic Ocean is a mass of ice-floes moving in a general clockwise direction throughout the whole year. During the short summer, however, the ice melts away from the coast and open water can be found. The navigational problem lies in the fact that the pack-ice is moved by prevailing winds. A north or west wind will push the floes southward against the Arctic Coast, impeding or stopping transportation and perhaps wrecking ships. An east or south wind, on the other hand, will keep the coastal strip open and allow vessels to slip through safely. (16)

At present, Tuktuk (Port Brabant) is the distributing centre from which freight for the Western Arctic is transferred from river-boats to coastal schooners. The usual



Eskimo schooners at Herschel Island in 1930

Photo by R. Finnie





Roman Catholic Mission schooner Immaculata and another coastal schooner in Aklavik channel. Richardson Mountains are seen in background.

Photo by C. H. D. Clarke

schooners are small 25 to 75-ton vessels with shallow drafts of 6 to 12 feet. They are easily accommodated in the 14-foot harbour at Tuk Tuk. Most of the present supplies used by the Western Arctic posts are actually carried by three vessels, *Fort Ross*, *St. Roch*, and *Lady of Lourdes*, with lesser amounts being transported by smaller Eskimo schooners.

The schooners stay close to the coast in Amundsen Gulf, where their shallow draft often allows them to proceed inshore from grounded ice. In island-studded Coronation Gulf, navigation is easier during the generally ice-free months of August and September, and supplies are carried as far eastward as the posts at Cambridge Bay and King William Island. The possibilities of traversing the loosely-discussed Northwest Passage via this route are limited by a short open season, shallow water and lack of resources to support traffic. ⁽¹⁶⁾

THE YUKON WATERWAY*

In the opening-up and development of Yukon Territory the Yukon River played an important and continuous part. Although its length of almost 2,000 miles makes it the fifth river of North America, only a third of it lies in Canada. The publicity given to the Alaska Highway and the line of air bases has caused the steady and dependable water route to be overlooked. Until these current developments took place, most of the freight and supplies entering the Territory, and nearly all of the exported ores, were carried via the White Pass and Yukon Route (which includes the railway and water transport companies).

The navigation season on Yukon waterway lasts for a period of about five months, varying slightly in the spring. The first boats usually leave Whitehorse about May 15-25, as soon as Lake Laberge is free of ice, and the last boats are away from Dawson in

*Material compiled by W. F. Lothian at the Bureau of Northwest Territories and Yukon Affairs, Ottawa.



*Suspension foot-
bridge over Miles
Canyon in Lewes
River*

W.P.&Y.R. photo

early October to arrive at Whitehorse for wintering by October 15.

From one of its southwestern sources in Summit Lake, British Columbia, within 15 miles of tide-water on the Pacific Coast, the Yukon waterway flows northward through Yukon Territory for 637 miles. The waters of other mountain lakes—Bennett, Tagish and Atlin, on the Yukon-British Columbia boundary—are ultimately combined into the Lewes River, which drains the north end of Tagish Lake.* Miles Canyon and the rapids south of Whitehorse are impassable to river traffic, so that the head of navigation, and northern terminal of the railroad, is at Whitehorse. Northward and westward the Yukon is navigable without interruption for a distance of 1,777 miles to its outlet through Apoon Pass in Alaska.

The present well-developed drainage system of the Yukon is greatly influenced by the past glacial history of the region. When ice-caps topped the mountains surrounding the Yukon plateau, glaciers fingered downwards and gouged deep and broad valleys into the plateau surface; large streams drained the glaciers and cut broad channels towards the main rivers. Since the disappearance of the ice-caps, the present streams have been supplied only by the low precipitation (9 to 13 inches annually) of the area, and are thus much smaller streams which meander across generally flat-bottomed valleys. (17)

Because the tributaries of the Yukon have their sources in the semi-circle of

mountains around the central plateau, there is a difference in period of high water for navigation. Snow-fed streams, such as the Teslin, Pelly and, to a lesser extent, the Stewart, heading into the southeast and east, come quickly into flood after break-up in late May, and, by late July and August, they are dependent entirely on rainfall and may become quite shallow. The glacial-fed streams, Lewes and White, which rise in the scenic Coast and St. Elias Mountains (containing Canada's highest mountain) are slower in gathering volume and reach their peaks in July and August.

As a result of the above condition, Lewes River, north of Whitehorse, was still low when river transportation should begin, while the river north of the junction of the Teslin was high and at good navigation stage. This situation was remedied in 1925 when a dam was built across Lewes River above Whitehorse to hold back water during the late autumn and winter. The dam was progressively opened after May 1, and the release of water raised the level of Lake Laberge, breaking up the ice around the shore. This method has been successful in advancing the date of the opening of navigation from early June to mid-May below Whitehorse. The time of spring break-up in Lake Laberge, as in Great Slave Lake on the Mackenzie, is the key to the opening of navigation on the Yukon waterway.

No systematic survey of the channels of the Yukon has been made, but experienced river-men estimate that there is a minimum

*About half of the length of the Yukon waterway in Canada is called Lewes River on maps, the name Yukon being given north of the junction of the Lewes and Pelly Rivers at Selkirk. In the Territory the whole river is locally known as Yukon River.

*Whitehorse Rapids
south of Whitehorse,
Yukon*



depth of 4 feet at low-water stage in the main channel from Whitehorse to Dawson. Average depths are, of course, greater.

Although there are no obstructions to river transportation on the main Yukon waterway, there are a few places where navigation is hazardous and experienced pilots and captains are necessary. ⁽¹⁸⁾

Between Lake Laberge and the mouth of Teslin River there is a stretch of fast water, with several boulder-strewn riffles and shallow rapids, known as "Thirtymile River". Work is done on this section each year by the Navigation Company and Dominion Department of Public Works, but anchorage, freed from the river bottom in spring, continually carries boulders and deposits them in the channel.

Twenty-five miles north of Carmacks, Five Finger Rapids are one of the navigation difficulties in the river. Here four small rocky islands split the river into five chan-

nels, of which only the eastern one is navigable for steamers. A current of about 10 miles per hour is a serious upstream handicap which is overcome by means of a cable from shore attached to power-capstans on the decks. The cable is also necessary during high water when there is a distinct fall in the rapids, causing the stern of the paddle-wheeled vessels to be above water, resulting in a momentary loss of power.

Six miles to the north, Rink Rapids cover sunken reefs lying at an angle to the channel. Navigation around this bend is accomplished by "jack-knifing" (angling the barges from the front of the steamer), so that the barges are carried out over the reef while the steamer remains in the channel. This method is also used in negotiating particularly sharp bends in the river.

At Fort Selkirk the waters of the Pelly swell those of the Lewes, and the resulting broader river is known as the Yukon. In

Five Finger Rapids in Yukon River north of Carmacks

W.P.&Y.R. photo





Numerous islands and sandbars in Yukon River near Selkirk. Note the flat-topped, dissected plateau surface.

R.C.A.F. photo



Silt-laden White River near its junction with the Yukon

R.C.A.F. photo

the 90 miles from Selkirk to the junction of White River the Yukon is clear and gentle with numerous islands, lying chiefly in its central part, breaking the river into several channels. White River is a silt-laden stream entering the Yukon from the west, adding more bars and islands to the main river northward, but not hindering through-navigation. Below the junction of Stewart River the characteristics of fairly deep water, a gentle current, picturesque islands, wooded river terraces, and sloping hills in the distance are found along the Yukon to the boundary of Alaska, 88 miles from Dawson.

YUKON RIVER TRIBUTARIES*

Most of the traffic and freight of Yukon Territory is carried on the main waterway, but several of the tributaries are navigable and have local steamer or gas-boat service. The scenic lakes along the Yukon-British Columbia boundary also have boat service during the five-month summer season.

Teslin River is navigable by the larger steamers throughout June and early July, but traffic ceases during the low-water period of late summer. This characteristic is also typical of Pelly River and its main tributary, the Macmillan, but, since there are no large settlements along these streams, only small barges with outboard motors currently use the rivers.

Stewart River is navigated by the river-boats, but has a channel which shifts each year. Because of its source in the high Mackenzie Mountains, the Stewart receives an important rise from rains during early September which prolongs the navigation season. Before the Treadwell-Yukon mine near Mayo closed in 1941, large steamers made twice-weekly trips up the Stewart during June, carrying down large tonnages of ore. In July and August, a smaller boat, drawing $2\frac{1}{2}$ to 3 feet of water, pushing smaller barges, continued the transport service.

White River has been navigated by small stern-wheelers as far as Snag, 100 miles upstream. The river is high into late summer with no rapids, but the channels change location rapidly owing to the great amount of silt carried from the mountains.

Porcupine River joins the Yukon 321 miles below Dawson at the town of Fort Yukon, Alaska. Freight for the Indian settlement and trading-posts upstream at Old Crow, Yukon, is carried through Alaska in bond and delivered by small gasoline-driven river-boats.

PRESENT TRANSPORTATION**

Controlled by natural features, an efficient system of river transportation has evolved in Northwestern Canada, adapting

*Information supplied by Dr. H. S. Bostock, Geological Survey Division, Department of Mines and Resources.

**Information on Mackenzie and Yukon River systems supplied to the Bureau of Northwest Territories and Yukon Affairs by the companies named.

*Steamer Whitehorse in Five Finger Rapids,
Yukon River*

W.P.&Y.R. photo

itself to the limitations and advantages of the northward-flowing rivers. From time to time booms have occurred which found transportation facilities inadequate, and more equipment was constructed and improvements made. During 1942-44 the waterways passed through such a period of unusual activity in which many changes took place, and the present systems are adjusting themselves once more to peacetime conditions, being better equipped to handle normal traffic.

Freight on the Mackenzie waterway is carried by large barges pushed either by stern-wheeled steamers (formerly wood-burning, but converted to oil-burning in 1945), or by small propeller-driven, diesel-engined motor vessels. Although the steamers carry some passengers and tourists, the motor vessels are primarily concerned with transporting freight. At the close of the 1944 season, the four chief transportation companies using the river system, Mackenzie River Transport (Hudson's Bay Company), Northern Transportation Company Limited (now government-owned), Yellowknife Transport Company Limited (plying chiefly to Yellowknife) and McInnes Products Corporation Limited (mainly interested in exporting fish), had a total of four steamers (all M.R.T.), 23 motor vessels (14 north of Fort Smith), and 58 barges (including 3 refrigerated).

Barges are the distinctive sight of Mackenzie River transportation. (19) They were introduced after World War I in order to increase the capacity of each trip; as the North developed, freight increased, and the number of barges grew. Whereas the old steamers used to push one or two barges for peacetime traffic, in 1942 the *Distributor* pushed five barges, with a record load of 1,500 tons, in one trip to Camp Canol. Barges are usually pushed ahead of the blunt-nosed boats, two or three in a line, and the others are lashed alongside. The

Right centre:—

Northern Transport Co. shipyard at Bell Rock, near Fort Smith; new steel barges are under construction.

Right:—

Hudson's Bay Co. river steamer Distributor and four barges at Fort Norman

Photo by Eric Fry



motor vessels are able to tow the barges in rough water—a feat which the stern-wheelers cannot accomplish. Since nearly all freight goes north by the barge method—from perishable fruits to heavy mining equipment—loading is a careful procedure which involves making certain that supplies for each settlement, in down-river sequence, are grouped together, and that the barge remains evenly loaded. ⁽²⁰⁾ The ease and efficiency with which all-important

annual supplies are delivered is apt to belie the amount of careful organization and difficult navigation which lies behind freight and passenger movement. ⁽²¹⁾

One of the chief economic problems faced by the transportation companies is the small volume of southbound freight compared with the grand total of incoming supplies. The following table illustrates amounts of freight (in tons) moved on the Mackenzie waterway in recent years:

Year	Northbound from Waterways	Northbound into N.W.T.	Point to Point in N.W.T.	Southbound to Waterways x
1938	19,003	13,474	3,000	4,766
1939	16,521	8,550	4,045	4,996
1940	15,108	9,030	4,698	2,273
1941	19,364	13,613	4,471	3,123
1942	31,500 xx	15,794	10,892	2,981
1943	21,817		18,097	1,297
1943 (U.S. Army)	25,552			
1944	22,522 (inc. 7,639 for U.S.)			8,377xxx

xIncludes gas and oil from Norman Wells to Yellowknife.

xxIncludes 19,543 tons moved for Canol Project.

xxxIncludes 7,295 tons removed by N.T. Co. from Joint Defence Project.

Most of the freight moved along the waterway is handled by the two chief transportation companies, with the Mackenzie River Transport (H.B.C.) carrying the largest share of northbound supplies (chiefly trade goods and foodstuffs), and the Northern Transportation Company handling most of the southbound freight (chiefly ore and concentrates from the mines and oil from Norman Wells to Mackenzie District settlements). The great importance of

water-borne freight is well illustrated in the following table, which compares average tonnages carried by the various water transport companies with the average total carried by air transport during the past seven years. Despite the undoubted value of aircraft in opening up and developing Mackenzie District these few figures graphically show the vital and steady role which the Mackenzie waterway has always played in the North.

Average Annual Tonnage Carried 1938-44				
	Northbound from Waterways	Northbound into N.W.T.	Point to Point in N.W.T.	Southbound to Waterways
M.R.T.	13,909 (67%)	7,322 (60%)	3,454 (45%)	1,089 (27%)
N.T.C.	5,789 (28%)	3,741 (31%)	3,502 (47%)	2,824 (71%)
Others	1,135 (5%)	1,029 (9%)	578 (8%)	61 (2%)
By Air		166	297	36

In Yukon territory, one company, the White Pass and Yukon Route, carries most of the freight and passengers. It has eight steamers and gas-boats operating north of Whitehorse and two steamers on Lakes

Bennett and Tagish. The largest of these boats average about 150 to 200 feet long, 30 to 40 feet wide, and have a gross tonnage of slightly over 1,000 tons. The steamers on the Whitehorse-Dawson run are wood-

WATER TRANSPORTATION IN THE CANADIAN NORTHWEST

burning, and stop to load fuel at various points along the river. Nearly all push barges when freight is the main consideration. In normal times a twice-weekly service between Whitehorse and Dawson was maintained, with the downstream trip taking about two days.

Freight tonnages handled in the Yukon are

not as great as in Mackenzie District, and are largely dependent upon the state of the mining industry. On the other hand, the passenger and tourist trade was more developed in the Yukon than along the Mackenzie waterway. Normal freight movement (in tons) in the Yukon is illustrated by the following table:

	1939	1941
Whitehorse-Dawson	5,871	6,207
Mayo-Whitehorse	11,012 (inc. 9,050 tons of ore)	2,865x (inc. 1,900 tons of ore)
Dawson-Nenana, Alaska	1,240	1,532

xTreadwell-Yukon silver-lead properties closed in 1941.

CONCLUSION

New developments in the Canadian Northwest during the past three years may have some influence upon the future place of water transportation. ⁽²²⁾ The line of airfields through Yukon to Alaska will probably not greatly affect the volume of traffic on the waterway, and may even increase it. The all-weather Alaska Highway only services the less-populated areas of the Yukon where river transportation never could adequately reach, and will undoubtedly prove an efficient way to distribute rail-borne supplies from Whitehorse to southeast and southwest Yukon. North of Whitehorse the broad Yukon waterway remains a cheap route over which to carry the Yukon freight.

In the Mackenzie Valley, airfields at every settlement north to Norman Wells mean that rapid passenger service is available throughout the year. Air express, however, does not compete economically with cheap water transport, and actually only assists the latter by removing some of the "rush" items from its cargoes. The new all-weather road which is to be constructed from the railroad at Grimshaw (west of Peace River, Alberta) north to the mouth of Hay River, on Great Slave Lake, may be of more importance to the future of water transport.

The completion of the Hay River road will mean that two of the main physical problems of the Mackenzie waterway—low water in the Athabaska delta, and the

rapids in Slave River—will be avoided, and an ultimate extension of the road to the vicinity of Fort Providence will by-pass the third major delay—the ice of Great Slave Lake. Since most of the freight along the road will be destined for Yellowknife, and will still have to cross Great Slave Lake, it will remain for the future to show whether transport by motorized equipment can be more economical than by water transport—even with the latter's delays, owing to low water, inclement weather, and the Fitzgerald-Smith portage.

The history of the Mackenzie Valley has always been closely connected with that of the waterway. If past historical events can predict future trends, the Mackenzie is about to begin a new era. Routes into the valley have changed over the years: La Loche Portage was replaced by Athabaska River when a wagon-road was constructed north from the end of steel at Edmonton; The Athabaska route was replaced by Peace River when rail connections reached the latter; both routes were replaced by the present waterway from McMurray when the railroad was extended farther into the Northland. The present road development shifts the balance in the other direction, back to the Peace River railway route and northward by road.

The Mackenzie waterway, with all its difficulties and problems, has done a magnificent job in carrying the needs and exports of the Mackenzie Valley. It has met many

transportation crises, and each time proved capable of supplying the residents at reasonable cost; but now a new and serious competitor is entering the field, and only the future will show how the southern part of the waterway will survive this latest development.

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River-boats and barges (top to bottom):—

M.V. Clearwater at Fort Fitzgerald

Radium Queen on Slave River Photo by M. Meikle

The Slave being repainted at Bell Rock.

Barges being loaded with gasoline drums at Norman Wells.

Northern Transport Co.'s Slave unloading supplies at Arctic Red River.



The Craft of the Geographer*

by GEORGE H. T. KIMBLE

GEOGRAPHY isn't what it used to be. That, perhaps, is just as well, since for many older members of my audience their most vivid recollection of this subject will be the hours spent at school wrestling with the names of all the railway stations between Halifax and Vancouver, and, in the words of Chaucer (for this particular form of pedagogic tyranny has had a long vogue),

"alle the havenes, as they were,

From Gootland to the Cape of Fynystere,
And every cryke in Britaigne and in

Spayne".

While everybody knows that this kind of thing is no longer taught, it is quite clear, from statements commonly made in the press and other "well-informed circles", that by no means everybody knows what has taken its place, or what the geographer of to-day regards as his real business in life.

Modern geography may be defined as the study of the localization of ways of living, since it is primarily concerned with viewing the earth as the home of human communities and cultures, and with examining the ways in which man has shaped the habitable parts for his own ends, and has himself been influenced in the process.

Underlying this study is the knowledge that the environment in which man lives does not represent a haphazard conjunction of conditions, but a grouping in response to various physical and biological controls. This applies to wind and weather, as well as time and tide—to the global distribution of natural resources, as well as the life cycle of plants and animals. To take only one instance: the wind, for all its apparently erratic behaviour (Does it not say in Holy Writ: "The wind bloweth where it listeth . . . thou canst not tell whence it cometh, or whither it goeth."?), is, in fact, subject to rigorous control, for, as Buys Ballot discovered many years ago, north of the equator winds always go anti-clockwise around

low-pressure systems and clockwise around high-pressure systems, the reverse holding good south of the equator.

Since the human environment is compacted of so many diverse elements, it follows that the geographer is, to a very large extent, dependent for his material upon other sciences: on the physical side he draws heavily upon physics, geodesy, geology and geomorphology; on the biological and human side, upon botany, agriculture, ethnography, economics and history. This "borrowing" of material is, of course, a common practice in all scientific and technical work. Doctors daily avail themselves of the knowledge of the chemist, electrical engineer, precision-instrument maker, radiologist, anaesthetist, psychiatrist and so on; in the same way, the house-builder calls in the corporation surveyor, the stone-mason, brick-layer, plasterer, decorator and plumber. No doubt in the past many students supposed that their job was finished when they had collated (scissors-and-paste fashion) the more "geographical" parts of these cognate subjects; in point of fact, however, none of them really covers the geographer's field. Consider, for example, the phenomenon of rain: the physicist's interest in this subject may be said to end the moment he has solved the question of *how* it is produced; the geographer, on the other hand, wants to know *why* it falls *where* it does and *when* it does (that is, he wants to know—what are the factors governing its regional, seasonal and diurnal distribution); and he is equally interested in finding out what sort of response the rainfall, at a given place and time, elicits from the plants, animals and men living there. Or take the subject of land-forms, such as mountains, valleys and plains: to the geomorphologist it is their mode of origin and the evolution of their present-day configuration that is of primary interest; to the geographer what matters most is their actual

*The Inaugural Address delivered by Lt.-Commander George H. T. Kimble, Professor of Geography and Chairman of the Geography Department at McGill University, in Moyse Hall, on April 20th, 1945.

geographical location, their spatial relationships within the regional framework of the world, and their influence on the location of towns and villages and on the activities (agriculture, mining, industry and trade) carried on by the inhabitants of such communities. In short, it is their *functional* significance that concerns him most directly.

The geographer, therefore, tends to think in terms of distances and shapes (i.e., maps), much as the musician does in terms of notes and scales. Ideally, his statements should be capable of being expressed in map form. If he cannot express them in this way, it is a moot point whether his work is legitimate. At all events, it would be generally agreed that the quality of the geographer's contribution depends largely on the effectiveness with which he employs his cartographic technique.

It is this habit of thinking of man—not abstractly as Mr. Everyman of no fixed address, but concretely (we might almost say “cartographically”) as Tom Jenkins, coal-miner in Lethbridge, Alberta; William Smith, fruit farmer in Lower Ontario; and Pierre Rousseau, habitant in the lower St. Lawrence (that is, as a member of a specific cultural region making representative contributions to the character of that region)—that constitutes the distinctive feature of geographical studies. Without “the touchstone of areal studies”, physical geography quickly becomes indistinguishable from geology, oceanography and meteorology; biogeography from botany and zoology; economic geography from economics; and social geography from sociology. Worse, physical geography and the other constituent branches of the subject tend to become ends in themselves—in fact, specialisms which recognize no disciplinary bonds between one another, and which possess little or no cultural purpose.

Let us enumerate some of the questions the geographer asks himself as he examines a given region. One of the first questions is usually—why does man use the land and its resources in the way he does, and how has he altered them by his occupation? Next, he will, most likely, want to know—what are the advantages and handicaps of the region

from the standpoint of human needs, and in what respects has it hampered the inhabitants, and in what respects has it left them free agents? Next, he will probably ask—what relationship, if any, exists between man's territorial arrangements, political institutions and ideas, and the regional environment? After this, he may inquire how far the social life of the region (the customs of its people and their modes of living together) is a product of the soil, and to what extent it stems from racial inheritance.

The first set of questions can only be answered after examining the existing economic adjustments in conjunction with the historical development of the region. The second set can only be answered after we have mapped the significant physical and biological distributions (which information, incidentally, is a prerequisite of all regional planning). The third question cannot be answered directly, but only after being referred to the first and second. “Failure to do so”, as Professor Barrows of Chicago once said, “invites untenable generalizations and helps to make much so-called political geography really political theory, with, at best, a geographical slant.” It will probably be protested that the last question takes us outside our field into the debatable terrain between geography, sociology and anthropology. My excuses for posing it, however, are: first, that the geographer, as a field worker, has opportunities to make observations on how material cultures arise that other social scientists are not likely to secure (because they, for the most part, are not accustomed to field observations); and secondly, that geography should help us to understand the differentiation of cultures, and it is impossible to obtain an understanding of this sort except by learning the methods and devices men have used for making a living out of their homelands.

Dr. Carl Sauer, of the University of California, has recently illustrated this point: in his Presidential Address to the Association of American Geographers, he argued that if pack trails are geographic phenomena (and no one, I imagine, will dispute that they are),

then the pack trains that use them are also; so, too, the feeding places that the animals use and the fodder or forage on which they depend. He then went on to ask why we should not also view as "geographic phenomena" the utility of the animal as to distance it can cover and the load it carries, and the whole process of loading and driving likewise—in fact *all* the processes involved in, and customs associated with, getting a specific (in this case, nomadic) form of livelihood.

Now the examination of all these questions presupposes an understanding of the manifold ways in which human life is affected by topography and drainage, by the distribution of mineral and soil resources and by the zoning of the world into distinctive climatic and ecological provinces. It also presupposes that for any given region we shall know the distribution and density of population, the various ways (productive and otherwise) in which the land is utilized, the characteristic forms of settlement and occupation, and the status of industry and commerce—in short, the whole personality of the culture. And since "personality"—whether of the individual or the region—is a function of inheritance as well as environment, of time as well as space, it is necessary to carry our examination far back into the past. Indeed, some of us would go as far as to say that *all* human time is involved, and that any predilection to consider the present as more important than the past misses "the expressed aim of geography as a genetic science"*.

But in making this examination the geographer is in some danger of thinking that, because he has split the whole of his subject into parts, be they territorial or chronological, he can next take those parts, stick them together again, and so have the whole once more. This is not the case, however, for the world of man is far more than a collection of card-indexed items; it is a living entity, profoundly complex (and not by any means always rational) in its behaviour, more given to initiating processes than finishing them, and, withal, a notorious spoiler of averages. It is no more possible to conjure up the life of a human region with the aid

of purely static studies—of, say, the distribution of its population and its economic activities at a given epoch—than it is to catch the full personality of an individual in a camera study. Something more kinematic is needed. For one thing, the environmental scene itself is not static. Unlike the ordinary theatre stage, it does not just consist of a number of dead "props"; it is animated—so much so that (to continue the metaphor) it frequently dominates the action of the "play". We all know how easily a severe storm or drought can change the face of the countryside *without* any collaboration from its inhabitants; furthermore, even when the surface is ostensibly at rest, ceaseless processes are at work, moulding, changing, renewing and redistributing its properties. The only constant features of the physical environment, we are almost tempted to say, are the processes of change, decay and renewal.

Then, of course, the moment we give geographical elements *human* associations (that is, the moment man enters the world stage), the scene becomes as changeful as man himself. The liabilities and barriers of one generation become the assets and stepping-stones of the next. Thanks to hydro-electric power, irrigation by remote control, and a sunny climate, uninhabited deserts, like parts of southern California and southwestern Alberta, are made to "blossom as the rose" and become the happy hunting-ground of real estate speculators; "white-man's graves", like Sierra Leone, are conquered by tropical medicine and lead to a reorientation of colonial policy; mountains, like the Rockies—even the Laurentians—, erstwhile neglected because of their storminess, isolation and unsuitability for ordinary agriculture, are turned into playgrounds, health resorts and sanatoria. Unfortunately, not all the changes are for the better. In many parts of the world the good earth has been turned into waste land. Nobody who saw or read *The Grapes of Wrath* will be in need of a homily from me on that point! But perhaps we do not all realize the extent of the damage: the Mississippi River alone carries down to the Gulf of Mexico a burden of

*Carl Sauer

top-soil amounting, annually, to approximately 400,000,000 tons. (In terms of plant-food, this is equivalent to about sixty times the chemical foodstuffs returned to the earth in various forms of organic and inorganic fertilizers.) In iron-rationed England, millions of tons of first-class agricultural land are yearly being destroyed in the process of winning gravel, chalk and ore from the earth.

Clearly there is no room here for the fatalism of the environmentalist or determinist, for while it is undoubtedly true that some men (in much the same way as plants and animals) accept their environment, the great majority consciously try to control, even to change, it. They, among all living things, have the unique power to understand the ordering of the natural world, to foresee what will happen next, and to anticipate it, if need be, by taking avoiding action. For instance, though frost cannot be averted, timely frost predictions enable commercial fruit-growers in California, Florida and southern Ontario to light smudge fires which minimize the hazard, even if they do not remove it. Again, though many areas of the world will always be subject to drought, dams and reservoirs built in or near those areas enable farmers there to secure a measure of control over their environment sufficient to make them well-nigh independent of climatic vagaries; the resulting stabilization of production goes a long way towards converting gamblers into planners.

This ability to plan and predict is the ambition of every thinking man—not least the scientist, for whom it is, at times, the basis of remedial programmes. But the value of any prediction varies directly with the planner's knowledge of the phenomena concerned; where such knowledge is partial, prediction is likely to do more harm than good. Thus, it is sheer folly to expect that any worth-while forecast can be made of the food resources of a region (let us say Northern Ontario or the Mackenzie Valley), its population capacity, or its most profitable lines of economic specialization, unless it is founded upon a close analysis of the character of the soil and the underlying

rocks, the climate (including the seasonal variations of heat and moisture, the incidence of drought and frost, and frequency of damaging storms), and those features of the terrain itself which are likely to influence farm practice (e.g., its suitability, or otherwise, for large-scaled mechanized agriculture). It was largely for want of such information at the time of their settlement that so many homesteads along the arid fringe of the Canadian prairies were abandoned; between 1921 and 1926, in the Medicine Hat area of Alberta alone, one farm in every three went out of occupation.

It would be equally foolish, though, to assume that because the planner has all the information he wants, his forecasts are bound to be right. Nature has a remarkable aptitude for *not* running true to form, and for springing surprises. As the Spanish proverb truthfully reminds us: "When God wills, it can rain with any wind".

Furthermore, the human element is sometimes about as imponderable as the natural! May I quote a personal illustration in this connection. In the spring of 1939, I went out to the Atlas Mountains of North Africa to undertake a field survey, such as I have just outlined, among the Berbers of that country. I was making a study of marginal environments at the time, and the Berbers constitute one of the oldest pioneer-fringe, or marginal, communities to be found anywhere in the world. I had not got very far before I realized that, if my work was ever to be more than a pleasant academic exercise, somebody would have to get to grips with the Berber mentality. It was one thing to collect a sheaf of notes and maps and say: "Here are all the facts you need to know about the Berber way of life, the *raison d'être* of its localization, and here are my conclusions on the way that economy should be expanded and modified to save an undernourished, grossly over-populated and rapidly growing community from mass starvation or compulsory emigration". It would have been quite another thing to get the natives to carry out the recommendations—even if the French authorities had been

agreeable to them! As a matter of fact, the French had already tried to introduce at least one change for the good of the natives; they had advocated the cultivation of potatoes, in an endeavour to lessen the Berbers' almost fanatical dependence upon mixed cereals and figs. With what result? Invariably the seed potatoes distributed for this purpose were added as a relish to the evening dish of *couscous* (usually this consists of a rather unsavoury mush of semolina helped down by a "no-questions-asked" kind of gravy!). They argued that if Allah had meant them to cultivate potatoes, he would have made them indigenous to the country.

This mental trait is very widespread among the Berbers, and among their co-religionists as well. A friend of mine, who knew the language, asked a ploughman, while I was there, why he didn't make life easier for himself (and, incidentally, make his field more productive) by removing the boulders that were always getting in his way—to which the reply came: "Allah put them there; let Allah remove them"!

How different, then, is the task of the geographer from that, let us say, of the physicist or chemist? The latter have before them myriad repetitions of the same phenomena. They abstract irrelevant aspects and isolate the relevant, and infer a law, according to which they can foretell, and in suitable cases produce, with certainty given results from given causes. But the geographer seeks to decipher the pattern of a unique phenomenon—the living surface of this globe. His object is to understand the concrete complexity—not to abstract and reduce it to simplicity. There can, for him, be no question of law or determinism in the physical sense, since there is no repetition of the pattern. Geography no more repeats itself than does history. So it really comes to this: no forecast involving natural and human elements can be more than a first approximation, and no forecast which does not reveal an expert insight into the normal behaviour of those elements need be taken seriously.

While the modern geographer is the last person to dogmatize about what can and

cannot be done with the cultural environment, he is no believer in magic. Admittedly, human ingenuity and enterprise have accomplished a great deal; they have extended the limits of the habitable earth, increased the human capacity of many lands, and made possible higher standards of living—but there are still very real limits to the number of people that can be supported on a given piece of land. Some countries (among them Japan, Great Britain and most of the western European states) have already reached that limit, so it would seem, and now contain standing room only. The population problems of such countries are likely to become exceedingly acute in the immediate post-war years, for these years can hardly be expected to see a return of the highly favourable circumstances of international trade in which the societies in question were nurtured. Suffice it to say that plans for international settlement which omit to take into account the geographical requirements of communities—be they whole countries, or merely industrial, commercial or cultural provinces—and assume that going concerns are made by drawing lines on a map, can never succeed. Nations need food as well as frontiers, and economic resources as well as tariff blocs and restrictive immigration laws. (This is one very good reason why planning should not be left to overworked statesmen living in the tense atmosphere of a peace conference; in any case, political expediency is never a good substitute for geographical realities.)

The Atlantic Charter admitted, by implication rather than expressly, the force of this contention when it declared that the signatories would "endeavour, with due respect to their existing obligations, to further enjoyment by all states, great or small, victor or vanquished, of access, on equal terms, to the trade and raw materials of the world which were needed for their economic prosperity". Exactly how this is to be done remains to be seen. In the case of Japan, to take only one instance, it is not going to be made any easier by the fact that she is to be stripped—according to the Cairo Confer-

ence of December, 1943—of all the possessions she has come by since 1894, when she had a population of less than 30,000,000, as against her 75,000,000 of to-day. This means that a country not much larger than the British Isles, with a smaller cultivable area and a much poorer mineral endowment, will be expected to support a population 60 per cent higher than that of the British Isles, and increasing by a round million per annum! Even if they were willing, the Japanese could not emigrate, for no country—not even Germany—will be disposed to admit them in any numbers after the war is over. Nor are their low-priced goods likely to find a ready market in America or Europe.

The main business of the geographer, then, is to assess the importance in time and place of those facts of environment that are operative in human affairs, and to apply his findings to contemporary problems. By bringing the study of man "down to earth" in this way, he claims not to be able to offer a self-contained system of explanations for man's social behaviour and institutions, but to provide one vantage point from which to regard these things. We can, perhaps, illustrate what we mean by likening the geographer to the spectator of a silent, captionless film. The film, by its very nature, is a record of things seen from one angle, with all the highlights and shadows, the limitations and advantages, peculiar to that point of view. At the same time, the film shows all there is to see from that angle, and this is usually a great deal more than the untrained eye can see, as anybody knows who has watched a prize-fight and subsequently seen it in slow motion on the screen. But, being silent, the film leaves very much to the imagination of the viewer; at best he can only guess what the characters in the story are saying or thinking, and why they behave as they do. All the same, if he uses his wits, he can probably get the gist of the story without the help of either captions or commentator.

So with the geographer: he sees all there is to see of man's relation to his environment and, with experience and training, can usually get the gist of what he sees. But, for a fuller understanding of the plot and byplay,

he requires the assistance of other students of humanity. The historian, for instance, can tell him how much influence the past (e.g., oral and written traditions, social institutions and conventions) has on the present; the economist, on his part, can say how far business interests, fiscal policies and ideologies have governed—and still govern—man's use of his resources, and to what extent industrial inertia—the momentum of the going concern—controls the location of his factories and towns; the technologist can point to man's growing power over environment, thanks to such inventions as the internal-combustion engine, the overhead transmission of electrical energy and the employment of new materials. And for those who have ears to hear, the preacher is always anxious to point out the fact that man does not live by economics alone—that many of his responses arise neither from the exigencies of his material surroundings nor yet from the needs of his mortal body, but from his spirit.

Assisted in this way, the geographer is able to apprehend more completely the life and work of the 2,000,000,000 men and women who henceforth are to be his near neighbours. And this, surely, is a vocation to which all thinking people are called.

* * *

Finally, a few words on what we hope to do at McGill to give substance to the ideas I have just outlined.

As some of you may already know, the Geography Department will form part of the Social Sciences' group of the Faculty of Arts and Science. This, it seems to me, is its most natural affiliation, since the social sciences are concerned with understanding the processes of culture origins, growths and extinctions, and the hierarchies of social organization, while geography (as I have striven to point out) is primarily concerned with examining these organizations and processes from the point of view of the manner and meaning of their localization. Interpreted thus, geography is much closer akin to economics and sociology than it is, for instance, to geology or physics. This does not mean, of course, that we shall not seek to work in close association with our physical-science friends.

on the campus, but it does mean that they have nothing to fear from the newcomer. We shall have a long enough row to hoe without volunteering to take on anybody else's!

It is true that meteorology (which we hope to develop considerably) is usually regarded as a branch of physics. But I understand that interest in the subject from that quarter has waned during recent years, and that an offer to resuscitate its study has been greeted by the Physics Department with almost a sigh of relief!

In view of the phenomenal development of air travel expected to take place after the war, the probable extension of settlement along the marginal climatic zones of the North, and the steadily-growing demands by farmers, orchardists, forestry experts, irrigation and hydro-electric engineers for rainfall forecasts, it is self-evident that Canada must sooner or later accord university status to the study of meteorology. McGill, with the facilities offered by its long-established observatory, and its proximity to one of the world's greatest air-terminals, is strategically situated in this respect, and is to be congratulated on giving a lead in the matter.

At the same time, we do not propose to sin against the light by building up a department devoted entirely to "specialisms" (like meteorology) possessing no cultural bonds or unifying aims. The guiding principle behind all our courses will be, to quote from a recent utterance of Sir Halford Mackinder (England's greatest living geographer), the pursuit of "an organically coherent discipline for the upbringing of the cultivated and efficient men and women who in various capacities must (help to) run our democracy" in the coming years. We must give them "a global outlook and a quick readiness to meet emergencies, for it was never truer that in this newly 'closed' world our stability is but balance, and wisdom lies in the masterful administration of the unforeseen. We must also", he concludes, "strive to give them an understanding of the momentum with which Man and his environment came to the present from the past."

It is with such thoughts as these in mind that we have chosen for our first courses of

instruction (to be given in the fall) the following subjects:

- (1) The general principles of geography
- (2) The elements of physical geography
- (3) The geography of North America, with special reference to Canada.

These, it is hoped, will suffice to show something of the scope and aims of the subject—its philosophy, if you like; its links with the humanities and the sciences; and its relevancy to the life of the American people. In particular, we shall endeavour to show (with the help of cartographical and statistical material) how the environment has influenced American and Canadian cultures from pre-Columbian times down to the present day; and how the lessons learned from this historical and regional analysis can help us to solve our contemporary problems—including, for example, the vexed question of extending the frontiers of permanent settlement and intensifying settlement of the regions already occupied. For, so we judge, it is not enough that geography should provide us with training for the intellect, furniture for the mind, and solace for the spirit. It should also seek to maintain constant and vital relations with the life of the community. If it does not, such cultural value as it possesses will be archaeological and precious, not contemporary and dynamic—the product of personal idiosyncrasy rather than common social purpose.

After all, in the last analysis, what matters is that we should be "doers of the word, and not hearers only"; that we should use the knowledge acquired by our studies—and for no less a purpose than the fashioning of a more decent world for our children.

Is it too much to hope that those of us who profess faith in the social value of the geographer's craft will be able to contribute, along with our fellow craftsmen on the campus and in the city, both vision and skill to this most imperative task?

If we can, then perhaps one day, to borrow those well-known lines of John Addington Symonds,

"A loftier race
Than e'er the world hath known, shall rise
With flame of freedom in their souls
And light of science in their eyes".

Your Telephone Helped Build Radar

***Designing the Telephone System of To-morrow,
Bell Scientists Contributed to our First Secret Weapon***

RADAR, the magic eye which spots objects, sometimes hundreds of miles away, through darkness, smoke, or fog, owes much of its present high state of development to telephone research, a recent announcement reveals.

Bell Telephone Laboratories designed some 100 different radars in all fields of application. The Laboratories had a larger group of engineers and scientists working on radar than any other industrial organization, and developed more radar designs and completely new and essential components.

In preparing and publishing textbooks for training men in military electronics, the Laboratories became one of the largest wartime publishers on the continent, both for size of printings and the number of book titles. In the field, the excellent quality of these texts was highly praised.

Telephone manufacturing organizations have produced more radar equipment than any other manufacturer. That is one reason why there has been, and still is, a shortage of equipment to serve new telephone subscribers here at home.

Telephone research and manufacturing were able to play a major role in developing this famous "secret

weapon" because of their wide experience in electronics and high-frequency electric waves and in the development of intricate systems of electric circuits.

For example, it was telephone research which evolved from De Forest's first audion the *high vacuum tube*, which made radiotelephony possible, including the first ship-to-shore and aeroplane-to-ground systems.

One of the major radar components produced by telephone manufacturers was the magnetron, a special electronic tube, without which practical microwave radar would not have been possible. Parts of these tubes require very delicate machining, and great credit goes to the engineers who solved the problem of successful mass-production of these intricate parts.

It was also Bell Telephone Laboratories which perfected the *electric wave filter* for controlling high-frequency waves.

Bell Laboratories also developed the *terrain clearance indicator* for aircraft, a forerunner of radar in that it employs the principle of shooting radio waves against the ground and timing their return to the aircraft receiver.

In experiments with *coaxial cable* and *wave guides* for high-frequency waves, the Laboratories had made important discoveries which were immediately applicable to radar.

Finally, in working on *antennas* for overseas radiotelephony, telephone engineers produced a type suitable not only for confining reception to a narrow beam, but also for controlling the direction of reception.

Associated with radar transmitters and receivers are *electrical circuits* which accurately time the echoes from unseen objects and thus measure how far away they are and give their exact position. In some cases, other circuits enable the antenna to follow the object automatically as it moves. Bell Telephone Laboratories pioneered in the research on electrical computing portions of the radar bomb-sight.

Radar is merely the most outstanding of many contributions of telephone science to war. The basic research and manufacturing skill which aided radar development are now once more being directed upon the problems of telephone service. Improvements now projected for the telephone service of the future open up vast possibilities to the imagination.

SILENT LINK BETWEEN FIGHTER PLANE AND ITS FLOATING BASE

Symbolizing the close tie-line of communication between aircraft carrier and its planes supplied by radar, this photograph reveals a Grumman Avenger speeding past a flattop, with the latter's radar antenna outlined against the sky. The accuracy of fire of the five-inch gun batteries in the foreground is also aided by radar, much of which was the product of telephone research and manufacturing skill.

British Combine photo



EDITOR'S NOTE-BOOK

Commander William Strange, R.C.N.V.R., was trained at the Royal Naval Colleges at Osborne and Dartmouth during the last war; in 1918 he left the Royal Navy, owing to defective eyesight. Before taking up writing as a career, he prospected for oil in the West Indies, lectured in English for the Egyptian Government in Cairo and managed a sales company in Toronto. He has done a considerable amount of journalism, is author of three books (*Sunset in Ebony, Canada, the Pacific and War*, and *Into the Blitz*) and literally hundreds of radio plays and features. His feature, *Quiet Victory*, won First Award in the War Effort category from the Institution for Education by Radio at Columbus, Ohio—one of the highest awards on the American continent. Commander Strange joined the R.C.N.V.R. in January of 1942, and served for short periods on both corvettes and destroyers, following which he became Assistant Director of Naval Information at Ottawa; his appointment as Director has recently been announced. (See C.G.J. for November 1943 and November 1944 in which appeared the annual records of the R.C.N. for those years, also written by Commander Strange.)

* * *

George H. T. Kimble was born in London, England, and educated at Eastbourne Grammar School and King's College, London (taking his B.A. and M.A. in Geography), following which he lectured for five years at University College of Hull and for three years in the Department of Geography, University of Reading. After serving for over five years in the Royal Navy during World War II as a Lieutenant-Commander in the Naval Meteorological Service, he was released to take up duties as the first Professor of Geography and Chairman of the new Department of Geography at McGill University, and as Director of Meteorological Services there. Professor Kimble has travelled widely in Europe, Africa and America, and recently completed a 40,000-mile aerial tour of the world. His publications include:—*Geography in the Middle Ages*, *The World's Open Spaces*, *The Shepherd of Banbury's Weather Rules*, and *The Weather* (in collaboration with Raymond Bush).

* * *

J. Lewis Robinson—See C.G.J. for September 1943, August and September 1944, and February, March (biographical sketch), July and August 1945.

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AMONGST THE NEW BOOKS

Mammals of the Pacific World

by T. D. CARTER, J. E. HILL, G. H. TATE

(Macmillan Company of Canada, Toronto, \$4.00)

AN INCLUSIVE list of the mammals of the Pacific world, grouped according to species, with brief but adequate descriptions of their characteristics and habitat. It is illustrated with end maps and some seventy spirited crayon drawings. There is a glossary and a useful geographical index showing the animals indigenous to each island or district.

* * *

Highway to Alaska

by HERBERT C. LANKS

(D. Appleton-Century Co. Inc., N.Y., \$5.00)

MR. LANKS is probably the only man in the world who has travelled by motor from the Arctic Circle to the Straits of Magellan. He has written entertainingly of his trips through Central and South America (see previous review in these columns), and now gives an account of his journey in 1943 along the Alaska Highway, then under construction. On this expedition, Mr. Lanks was an accredited war correspondent, and had for transportation an army jeep with a trailer. While adequately and pleasantly written, his work impresses one as that of a photographer to whom writing is a necessary detail in connection with publication of the pictorial results of his journeying. As usual, he was equipped with an impressive battery of cameras, always loaded and ready for any glimpse of scenery or incident of the road, and it must be stated that his results are quite worthy of these elaborate preparations. The eighty odd photographs reproduced in the book are of outstanding merit and represent in themselves a vivid account of the Highway.

Mr. Lanks motored from Edmonton to Whitehorse, where he took a river boat down the Yukon to Circle City, and continued thence by road to Fairbanks. From Fairbanks he took side trips to Anchorage, Valdez and the fertile Matanuska Valley, and then travelled south on the Highway towards Whitehorse and Edmonton. At that time there was a partially uncompleted section of some thirty miles of muskeg through which a wide-tracked "swamp-cat" dragged his jeep by main force, making it possible for this hard-used vehicle to complete its journey along the whole length of the Highway.

Mr. Lanks seems to be in some confusion about continental divides in his text, though he shows the divide correctly in the end map. Canadian readers will notice a redundancy in his reference to "muskeg swamp". Possibly "swamp" has been added as an explanation for the American reader. All in all, one may suspect that Mr. Lanks had a most enjoyable trip, and he is able to convey to the reader, both in text and pictures, a large measure of his own enjoyment. There is an index and good end maps.

—P.E.P.



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THE HOUSE OF SEAGRAM

Mainsprings of Civilization

by ELLSWORTH HUNTINGTON

(Wiley, New York, \$4.75)

ANY book by Huntington, the well-known Yale geographer, is bound to be of interest, since he is endowed with one of the most fertile brains among American scientists. But this volume is especially interesting since it, to some extent, summarizes the conclusions set forth in twenty-seven earlier books—all of which deal with various aspects of human evolution in relation to physical and cultural environments. In the book under review the three parts discuss the effects of physical, biological and cultural stimuli upon the development of civilization.

In the first part Huntington seeks to compare the conventional historical picture of evolution with that of the biologist. He thinks of human progress as an irresistible tide, tending on the whole towards a better way of life. The minor episodes, such as the crusades, or the Roman Empire—though greatly stressed by the historian—are but minor ripples on the tide of progress, and evolution would have proceeded along somewhat similar lines if these particular phases had been absent.

In the second part he discusses heredity, and explains that his own position lies between the extreme views of the believers in the 'Nordic myth' and those of certain anthropologists who say that no mental traits are inheritable. He uses the word 'kith' to express a 'cultural group' of people, not necessarily all of the same biological 'race'. The reviewer has felt the same need for a word for a 'cultural group', and has suggested 'folk' or 'cult' for this concept. Huntington objects to the phrase 'French race', as should all scientists, since the French-speaking peoples belong to three distinct races.

A very interesting chapter deals with the peculiar advantages of the earth as a life-maintaining planet. It seems probable that there is only about one chance in six billion years that a water-endowed planet like the earth can arise among the myriad stars of the cosmos.

The section on race is very interesting, as, for instance, his discussion of the Japanese idea of themselves as the most superior race. (They are of course very mixed biologically, like most progressive nations.) But their statisticians make the most of their excellent lungs and their unusual powers of introspection (!), in which they claim to shine—since, obviously, in many physical traits they are not outstanding. One of Huntington's sentences is worth dwelling on: "If we had given the Japanese an immigration quota such as we allow the Romanians, our racial quality would not have been altered one hundredth of a per cent in a decade; and the events which led to Pearl Harbour might have been greatly alleviated".

Later chapters deal with biological changes due to migration. Unlike the reviewer, Huntington accepts the

changes in head-form postulated by Boas in the children of European immigrants to the United States. There seems no doubt, however, that young Americans are growing taller and more slender. Huntington adheres to the reviewer's theory that the broad-headed races are probably the latest and most progressive of modern peoples. These include the Swiss, South Russians and Northern Chinese, as well as others in this zone across the Old World.

The book abounds in charts dealing with all kinds of interesting facts, such as the belt of leaders who have been born in the United States along a strip from San Francisco eastward to Boston and the Carolinas. Huntington links this belt with the history of the Puritans and the Huguenots of Carolina, and their migrations to the west. One of his most interesting chapters deals with the Icelanders and the Newfoundland folk. In most ways, the environmental advantages are much greater in Newfoundland, but the cultural progress seems to have been approximately ten times as great in Iceland. He uses education, genius, libraries, literary output, etc., as his criteria, and comes to the conclusion that the Newfoundlanders have got about as far as their innate capabilities will allow them. This example illustrates the fact that Huntington is much concerned with *innate aspects* of human beings, which most geographers feel incapable of investigating. As in much of Huntington's work, we must accept his views as worthy of serious consideration, even if we are not able to assess them completely.

Later chapters analyse the developments of the Puritans, Parsees, Jews, Armenians, Nomads, etc., along somewhat similar lines. It must be remembered that Huntington has an almost unrivalled knowledge of the peoples of arid Asia, where he spent many years of his life as a young scientist.

The last sections deal with temperature and the most efficient types of climate. He discusses the seasons—their changes and their effects on business, on birth, and on many other vital human interests. Further chapters deal with cycles in human development, and with the effects of diet and of the ozone of the upper air. In all of these fields of research Huntington has blazed the trail. Canadians with geographical interests will find this one of the most stimulating books which they have ever read.

GRIFFITH TAYLOR

* * *

Against These Three

by STUART CLOETE

(Collins, Toronto, \$4.00)

MR. CLOETE, who is a South African, will be remembered for his excellent historical novels written around the epic story of the Boers. *The Turning Wheels* and *The Hill of Dores* were best sellers of a few years ago and were rated among the best of the novels of their

year. *Against These Three* is not a novel but a historical study of three great figures, Rhodes, Kruger and Lobengula, who held the South African stage towards the end of the last century, and whose clashing wills and diverse purposes epitomized the struggle of the old Africa, native and pastoral Boer, against modern industrialism.

Rhodes, one of the great men of his or any age, holds the centre of the stage. Tubercular, he first went to South Africa for his health, made an immense fortune in the diamond mines of Kimberley while still an undergraduate at Oxford, and became premier of Cape Colony and the leader of the great mining and financial interests whose desire for northward expansion threatened to engulf both Boer and native. Rhodes' character was paradoxical; one of the world's richest men, he cared nothing for wealth in itself, but esteemed it only for the power it gave him in furthering his projects. A complete misogynist, his natural affections were sublimated in his desire to expand the British Empire. He visualized a British Africa from the Cape to Cairo and, ultimately, a Pax Britannica throughout a world controlled by the Anglo-Saxon, whom he considered the highest type of mankind. The Rhodes scholarships, with which his name is chiefly associated in this country, were intended to train the leaders of this world state. He was a man of great personal charm who gave his friendship lavishly and loyally to his associates, and received from them an adulation little short of worship. Apart, however, from his friends and associates, he bought and sold men and their consciences without scruple, even as he warped policies and events to serve his ends. Mr. Cloete's appraisal of Rhodes is a thing divided in itself. His Boer blood loathes Mr. Rhodes' imperialism and determination to expand British influence at any cost, while he conceded a reluctant admiration for the great scheme of a united South Africa, and for the vast abilities and uncanny gifts for conciliation and combination which Rhodes used to further that end. Alternately, he names Rhodes as the original fascist, the forerunner of Hitler, and expresses his belief that had Rhodes and Kruger come together at the conference table the Boer War might have been avoided—and, with that, the bitterness that even yet builds a wall of separation between the Dutch South African and the English.

With regard to Kruger, his life and character, Mr. Cloete has a simpler task. There were no complications in the make-up of the Boer farmer, "Oom Paul", the uncle of his people and for a generation their ruler. One of the original Voortrekkers, who had fought for his life and killed his man while still in his teens, a famous hunter, a fundamentalist in religion, who referred all problems to his bible and never ceased to believe that the world was flat, Kruger was ambitious to preserve the free pastoral life of his people, and regarded the discovery of gold in the Transvaal as a major calamity. Slow to think, but with a hunter's keen perception, he was quick to act in an emergency and showed military

talents of no mean order, as evidenced by the decisive steps taken to smother the Jameson raid and the spectacular success of the Boers in the early stages of the war. "Oom Paul" lived to see his country defeated and overrun, and died in exile far from his beloved veldt. His lieutenants, Botha and Smuts, equally patriotic, but with wider vision and greater tolerance, built from the war-torn ruins of their country the Union of South Africa, which was, in a way, the dream of both Rhodes and Kruger, though neither could forecast its present form.

The third of Mr. Cloete's trio, Lobengula, King of the Matabele, plays a minor and tragic part. Ruler of a branch of the warlike Zulu tribe, he had all the characteristics of a savage chieftain, a great leader in war, bloodthirsty, cruel, sensual, and dominated by priests and witch doctors. The last native king to seriously oppose the white man's penetration toward the north, he led his people into a hopeless war, where his regiments were mown down with cannon and Maxims, and died a hunted refugee.

Mr. Cloete makes a great story of these three, their hopes and ambitions. Each died a disappointed man, frustrated, defeated, but something of their aspirations survives in the South Africa of to-day, which is so much the work of a fourth and, perhaps, an even greater man, Field Marshal Jan Christiaan Smuts. The reader may find the book repetitious in places (possibly Mr. Cloete is only attempting to emphasize his points), and there is, at times, a note of rancour and a tendency to place undue stress on rumour and surmise. Mr. Cloete is too close to the persons and events he describes to write objectively, but quite possibly his book is none the worse for these memories of ancient wrongs which go far to indicate the problems and difficulties of our sister Dominion.

* * *

Live Dangerously by AXEL KIELLAND

Translated from the Swedish by Carolyn Hannay.

(Collins, Toronto, \$2.50)

A FAST-MOVING story of the Norwegian underground in which a wealthy Oslo playboy becomes a member of an underground group headed by a beautiful young girl. The story follows the pattern of escapes, the rescue of prisoners from the Gestapo, the underground route to Sweden, and the demolition of a munitions plant. Eventually, all the band of patriots are killed by the Nazis except the beauteous leader and the reformed playboy who make good their escape to Sweden.

There is evidence that the book has suffered somewhat in translation and in an endeavour to make it conform to the style of the American thriller. Entertaining reading and excellent material for a moving picture.

—P. E. P.

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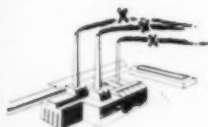
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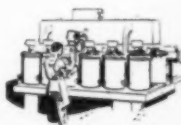
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